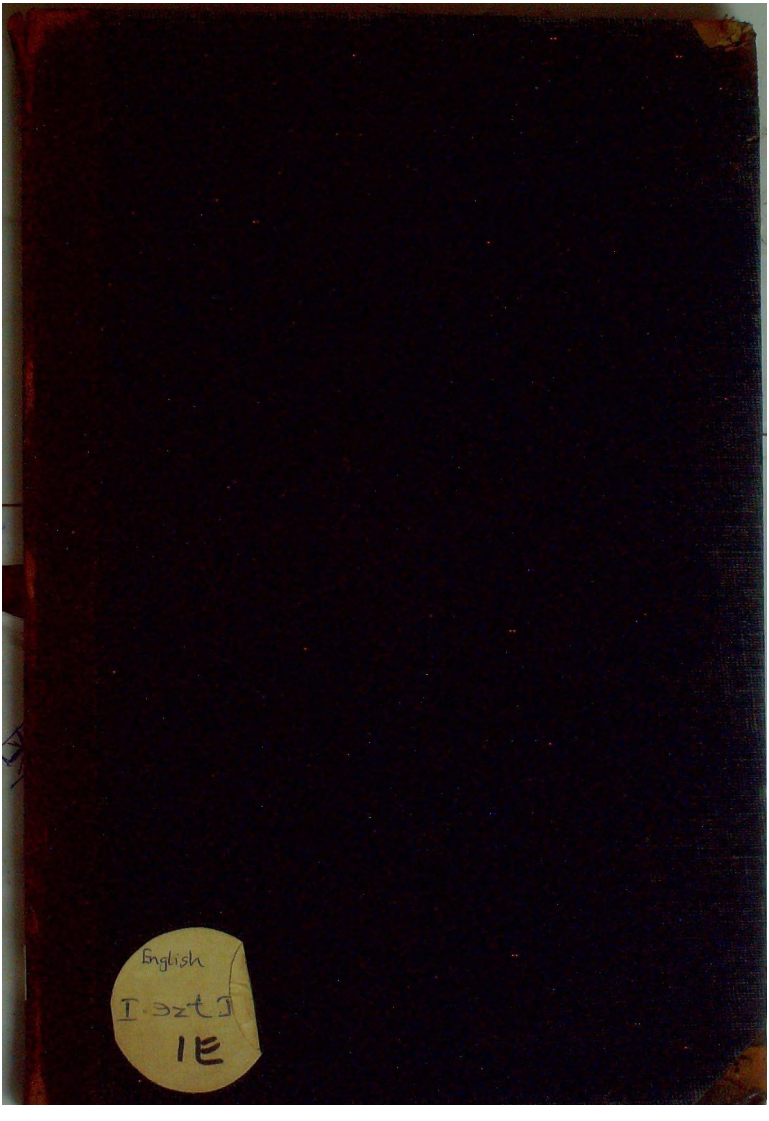
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THE INDIAN RUBBER BOARD BULLETIN

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INDIAN RUBBER BOARD

BULLETIN

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Date 28-7-71
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THE INDIAN RUBBER BOARD

Members, at 31st March, 1951

Mr. A. V. Thomas, *Chairman* „ A. V. George, *Vice Chairman* „ M. C. Chandy,	Nominated by the Rubber Growers Association of India to represent rubber growing industry.
„ A. S. Lal, I. C. S., Jt. Secretary, Ministry of Commerce & Industry. „ S. V. Ayyar, Chief Cost Accounts Officer, Ministry of Finance.	Nominated by the Central Government to represent the Ministry of Commerce & Industry.
„ R. L. Sethi, Agricultural Commissioner with the Govt. of India.	Nominated by the Central Govt. to represent the Indian Council of Agricultural Research.
„ R. M. Sundaram, I. C. S., Director of Agriculture.	Nominated by the Govt. of Madras to represent that Government.
„ P. A. Kassim, Dist. Collector, Kottayam. „ M. Sankara Menon, Director of Agriculture, Travancore-Cochin Govt. „ V. K. Velayudhan, Secretary, Development Department, Travancore-Cochin Govt. „ K V. Mathew (Kollamkulam) „ T. V. Kochuvareed.	Nominated by the Travancore-Cochin Government to represent that Government.
„ B. H. Whitehorn, „ K. Srinivasan, „ L. Aldred.	Nominated by the United Planters Association of Southern India to represent the Rubber growing industry.
„ P. Kurian John, „ F. Hawkings, „ A. V. John.	Nominated by the Association of Planters of Travancore, to represent the rubber growing industry.
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„ A. G. Shah	Nominated by the Central Govt. to represent Manufacturers.
„ C. N. Ioannou	Nominated by the Association of Rubber Manufacturers in India to represent Manufacturers.

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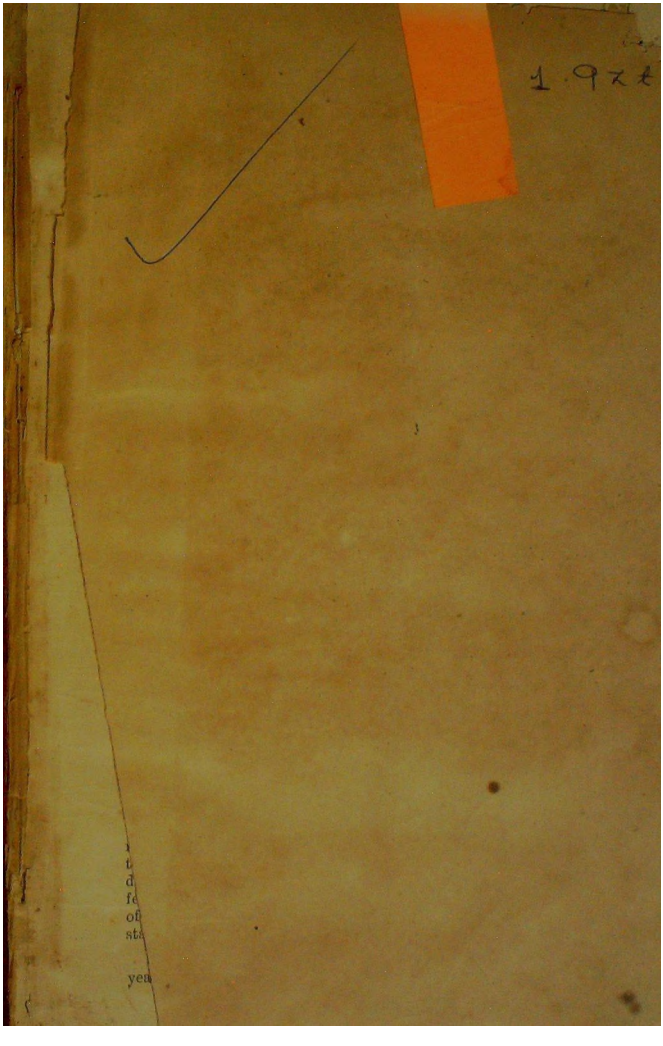

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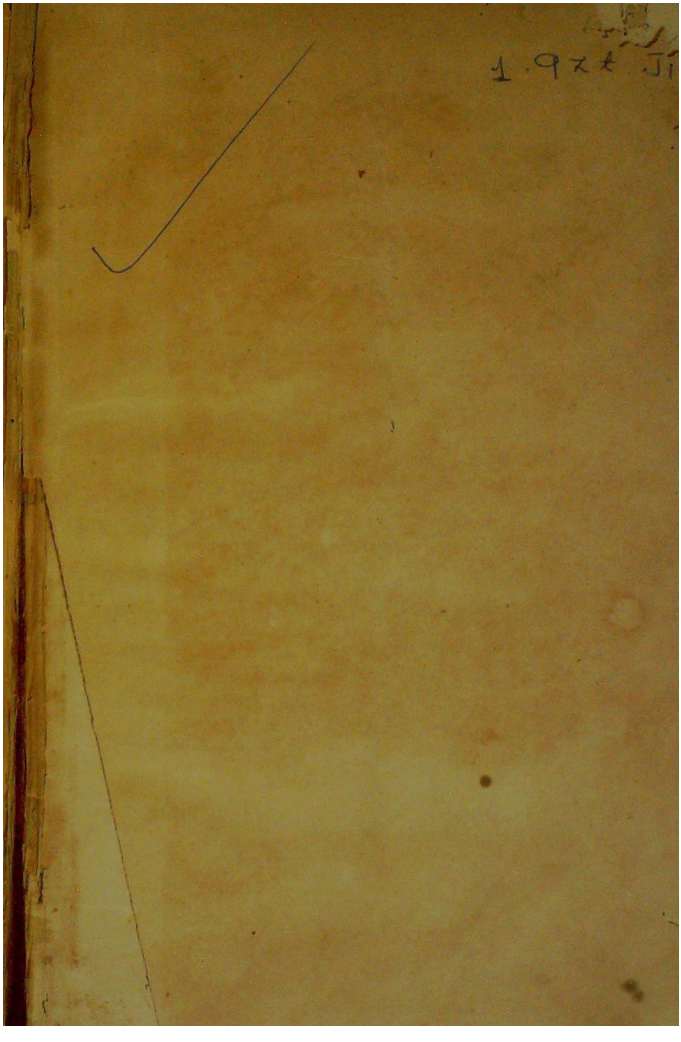

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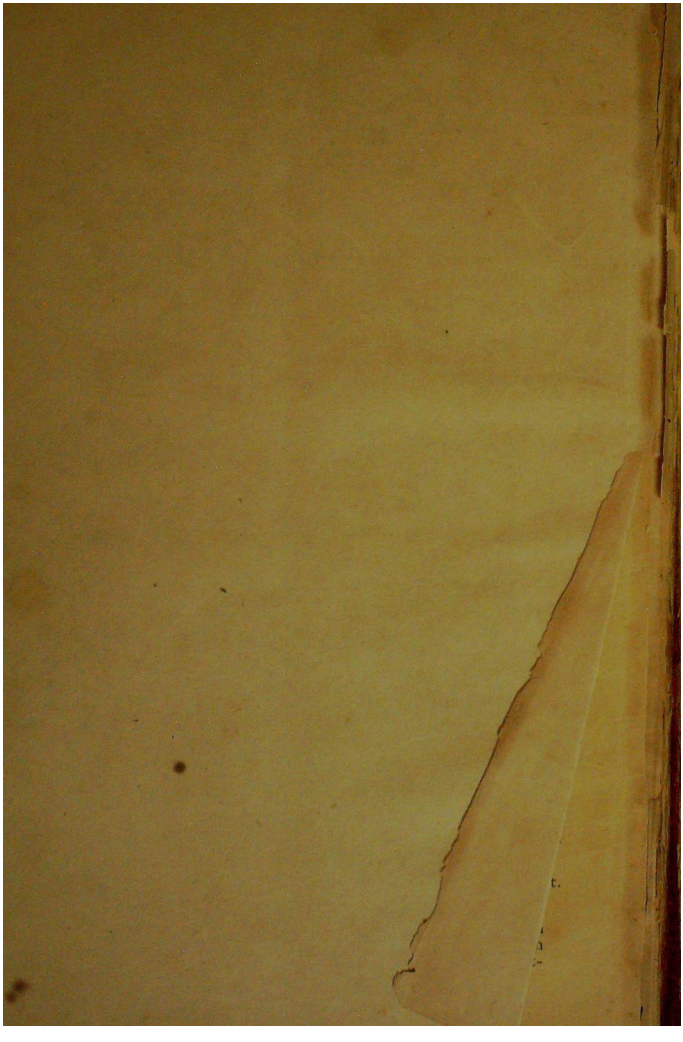

THE
INDIAN RUBBER BOARD
BULLETIN

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EDITORIAL

The publications of the Indian Rubber Board were being issued during 1949 and 1950 under the titles Serial Pamphlets and Special Pamphlets. The former was being published quarterly in English and Malayalam and the latter occasionally, in either languages. The Board has now decided to change the title of its publications to Bulletins and Special Bulletins or Planting Manuals.

From the favourable comments expressed by several readers we believe that the Pamphlets were popular among the Indian Rubber growers and that they have been serving the purpose for which they were intended—the dissemination of technical information relating to the rubber planting industry among those engaged in it. The growing volume of requests received particularly from small holders seeking technical advice, besides supporting the above belief, is an indication of the fact that even the small growers are becoming increasingly interested in adopting the latest scientific methods in the practice of rubber growing. It is to meet this increasing demand for technical information and the growing interest for scientific knowledge of the industry that the Board has decided to widen the scope of its publications and to change their titles as above. In addition to these, advisory leaflets or circulars on topics of current interest will also be published from time to time.

This is the first number of the Indian Rubber Board Bulletin. It is proposed to publish it quarterly. For the technical matter for the Bulletins, we have to depend largely on publications issued by the Rubber Research Institutes of our neighbouring countries, particularly of Malaya and Ceylon. With the kind permission of the Heads of these Research Institutes, which we are confident they will give ungrudgingly, we aim to make available to local rubber growers results of scientific researches being conducted there and practical methods of applying them to the rubber producing industry. Besides selected articles reproduced in full or in summarised form with due acknowledgment, other features of the Bulletin will be original articles contributed by members of the staff and readers, news, notes, announcements and Indian rubber statistics.

We have in our planting community pioneer planters with long years of practical planting experience. The wisdom derived from their

long experience and their mature judgments should prove valuable not only to the younger planters but also to the scientific worker and should therefore be recorded for the benefit of the industry. With this object suitable contributions from our readers will be gladly welcomed and published in the Bulletin if space allows. We welcome also constructive criticisms from our readers about the Bulletin which will receive due consideration.

Rubber Research

In the first of a series of articles entitled "The Need for Research" in the special edition of the Financial Times' Survey of the Future of Natural Rubber (July 31, 1950), Mr. Eric Miller, Chairman of the British Rubber Producers' Research Association, writes, "It is difficult to measure the debt which the natural rubber industry owes to men of science who with trained, observant and inquiring minds have helped it to grow from small beginnings into the supplier on a vast scale of one of the most important of our raw materials." In the same Survey, in another article entitled "Improving the Quality of Natural Rubber," which is reproduced in this Bulletin, Mr. C. E. T. Mann, Director, Rubber Research Institute of Malaya, has described briefly the scientific work undertaken in the rubber producing countries of the East.

Since the closing down of the Rubber Experimental Station at Mundakayam in 1932, no scientific research work on rubber has been undertaken in India. That the Indian rubber plantation industry has its own peculiar problems different from those of other rubber producing countries and that the progress of this important and strategic industry depends, in a large measure, on the solution of these problems have been appreciated both by the Government and the rubber grower. Many of our problems require the aid of scientific research involving investigations of the nature of long-term experiments for their solution. This fact and the urgency for the immediate establishment of a research station for rubber, even on a small scale, has also been realised by all concerned. The whole question, therefore, is now under the active consideration of the Indian Rubber Board.

DISTRIBUTION OF SELECTED CLONAL SEED BY THE INDIAN RUBBER BOARD DURING 1950

(By P. P. Cherian, Field Officer)

Introduction

With the object of encouraging the use of high yielding rubber planting material, particularly by small holders, the Indian Rubber Board has been distributing selected clonal seed among interested rubber growers since 1949. Work in this connection during 1949 has been described in the Indian Rubber Board Serial Pamphlet No. 3 (1949 pp. 5-8).

The Board decided to continue the seed distribution scheme on a larger scale during 1950. However as the quantity of clonal seed available locally as well as the demand for it could not be correctly estimated and also as facilities for germinating seeds at the premises of the Board were limited, it was originally proposed to limit the total quantity for distribution to about 100,000 selected seeds.

In spite of wide publicity given to the above decision, early applications for the supply of seeds from rubber growers were few in number. As the seeding season approached, however, the number of applications increased to such an extent that the total quantity applied for amounted to more than double that originally proposed for distribution. Quantities applied for by some parties exceeded 20,000 seeds and it was feared that it might not be possible to obtain and supply all the requirements during the seeding season which had already approached. Therefore, it was decided to limit the maximum quantity for supply to any one party at the nominal price to 4,000 seeds and if excess quantities were available, to supply them at cost price to those who required more. The nominal price to be charged was fixed at Rs. 15 per thousand seed.

Sources of Supply and Origin of Clonal Seed selected

The sources and origin of different families of clonal seed available in S. India are described in the Indian Rubber Board Special Pamphlet No. 3, 1949. The main sources of clonal seed supply in any large quantity are the rubber estates situated in South Travancore where the incidence of *Phytophthora* disease is not severe. In other rubber growing districts, further north, where the incidence of this disease is severe, it interferes with seed setting. Seeds were therefore obtained for the purpose of distribution from estates in S. Travancore.

The only variety of clonal seed available in India the yield of which according to present information should be of the same order as that of any other proved variety of seed is selfed (self pollinated) seed of clone Tj. 1. Illegitimate seed of Tj. 1 obtained from crosses with certain other proved male parents should also prove to be of high yielding quality. The 'hybrid vigour' which plants originating from cross pollinated seeds are believed to possess is an advantage under the Indian

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climatic conditions where growth of rubber trees is comparatively poorer. Here it should not be concluded that varieties of clonal seeds other than those of Tj. 1, mentioned above and which are available in this country, are inferior. In the absence of reliable records as to their yielding quality, however, it is not advisable to use them for planting except on a small scale.

For the purpose of obtaining both selfed and illegitimate seed of clone Tj. 1, four estates situated in S. Travancore were selected. On two estates seeds were collected from large monoclone fields of Tj. 1, surrounded by monoclone blocks of other clones. The majority of Tj. 1 clonal seeds collected from these fields should be selfed seed and the remainder crosses with other known clones. In another estate they were collected from poly clone fields where the larger proportion of the buddings consisted of Tj. 1 and the clones interplanted with it were Tj. 16, B. D. 5, B. D. 10, P. B. 25, P. B. 186, etc. and also a number of unproved local clones. In another estate, seeds were collected either from Tj. 1 monoclone areas or from fields where Tj. 1 & 16 were interplanted. Only on two of the four estates were there ordinary seedling trees present, but the particular fields selected for seed collection were situated far away from the ordinary rubber and so chances of pollination with them are very little. The actual seed collection from the demarcated fields of the estates was not supervised by the Board.

Collection, Packing and Transport of seeds to Kottayam

Instructions regarding collection of Tj. 1 seed and packing it for despatch were given to the estates concerned. Where necessary, a member of the estate staff was given sufficient training in the identification of the seed of this clone. Collected seeds were packed in dry powdered charcoal in gunny bags and despatched to Kottayam by arrangement with a lorry transport agency. It took, on an average, about three to five days for consignments of seeds to be delivered at Kottayam from the estates. Seeds packed in the above manner were found to be in good condition on arrival. But, in a few consignments, where the packing was done in moist charcoal powder with an additional lining of wet matting inside the gunny bag, a small percentage of the seeds had begun to germinate and get damaged.

Sorting and Germination

Soon after the receipt of each consignment at the office of the Board, the seeds were examined and sorted out. Seed of Tj 1, like that of other clones, has characteristic shape and marks on them which enable easy identification of it. Seeds other than those of clone Tj. 1 were thus rejected. The percentage of rejections in 12 consignments varied from 1 to 11 per cent with a weighted average of 3·8 per cent. This is rather negligible and indicates that the estates concerned could supply the right variety of clonal seed needed fairly correctly. Those who desire to obtain quantities of seed of a particular clone direct from the suppliers may therefore do so with confidence. In case of any doubt

about the identity of seeds supplied, however, these may be checked up with type sample seeds of the clone which may be obtained from this Board in advance.

Germinating beds were constructed at the office premises of the Board and seeds planted in the following manner :—Beds of fine river sand, 3 to 4 inches deep, 2½ feet wide and of convenient length, were prepared on sloping cement floors in covered sheds and on clean flat land under the shade of trees. It is claimed that seeds planted with the flatter (ventral) side facing the ground would give better germination and avoid distortion of the young shoot and root. But as this method would require more labour and as the seeds were to be taken out from the beds as soon as they began to sprout and before the growing shoot and root got distorted, it was considered unnecessary to follow that method in germinating beds. Therefore seeds were simply spread over the sand bed touching each other and pressed down into the sand so that the top surface of the seeds was in level with the surface of the sand bed. Watering was done with a garden-watering can fitted with a fine spray until the bed was thoroughly wet. The beds were then covered with loosely woven coir matting 2¾ feet wide which was also sprayed wet. Watering was continued as and when required to keep both the sand bed and the coir matting covers always moist.

Owing probably to the prevailing cool environment resulting from heavy and rather continuous monsoon rains the seeds took a longer time than usual for germination. It was only about 10 days after putting them in germinating beds that signs of germination were observed. Thereafter the coir matting cover was rolled up daily, all the seeds turned over and those which had the radicle just protruding out were picked up. The radicle which develops into the future root, at this stage, appears as a small, yellowish white, projection with a flattened end. The rate of germination in different consignments reached the peak between the 13th and 20th day. Seeds which failed to germinate within 4 weeks were discarded as they might produce weak seedlings which might not grow satisfactorily later.

Packing and distribution of Germinated Seeds

Germinated seeds as they were picked up from the sand beds were placed in trays and kept wet to prevent the radicle from getting dry. They were then packed in layers, one above the other, in moist saw-dust contained in wooden boxes of suitable size, care being taken to stuff sufficient saw dust between the seeds and between the layers of them and the walls of the box so that the tender sprouting root could not get damaged in transport. The boxes were not made air-tight but small spaces were left between the planks which formed the lid and sides so as to allow aeration. Otherwise heat would develop inside the box owing to respiration and the seeds would get mouldy.

As the rate of germination is influenced by many factors there was much difficulty in estimating the quantity of germinated seed available

for each day's delivery to rubber growers in various parts of the country. The small holders especially in out of way places had to be intimated far in advance about the date of delivery. This involved a large number of correspondence. In general all the arrangements worked out satisfactorily and 65 out of 71 parties took delivery of seeds from the office.

Results of Germination

Records of results of germination, over a period of 4 weeks, of different consignments of seeds are summarised in the following Table.

Estate	*Total No. of seed tested*	*Percentage of germination*
"A"	13,540	92
"B" (1)	23,000	89
"B" (2)	15,000	84
"C"	21,300	70
"D"	44,000	83
Mean		83·6

One consignment of 24,825 seeds despatched by estate "A" was delayed in transit by over a week. The percentage of germination of this consignment was 68.

Distribution of Ungerminated seeds

A number of estates and small holders, owing mainly to difficulties of obtaining quick transport, preferred ungerminated seeds and they were supplied accordingly. In these cases the ungerminated seeds, after they were sorted out, were re-packed in powdered charcoal and immediately despatched to the address of the estate or small holder concerned. The percentage of germination of some of these consignments as reported to us are as follows :—

Consignment	*No. of seeds*	*Percentage of germination*
1	7,200	25 to 35
2	2,400	45 to 50
3	4,800	48
4	6,000	53
5	12,000	87

Factors responsible for the low percentage of germination of the first four consignments of seeds could not be correctly ascertained. There

might have been undue delay in putting the seed in germination beds or the beds might not have been constructed properly and seed laid out and shaded suitably. An advisory leaflet on germinating beds for rubber seed is under preparation by the Board and those who intend to purchase ungerminated seed are requested to obtain copies of the same and to closely follow the instructions given therein.

Total quantity of seed purchased and distributed by the Board

The total quantity of Tj. 1 clonal seeds purchased by the Board from estates amounted to 195,794. Of this quantity 52,800 seeds were distributed as ungerminated seed and 107,715 as germinated seed and the balance rejected as rogues or because of non-germination within the 4 weeks' period. About 71 nurseries are reported to have been established with this seed in Travancore-Cochin, S. Malabar, N. Malabar and Coorg. From these nurseries sufficient vigorous growing seedlings to plant 500 to 600 acres may be estimated.

Costs

The clonal seeds were purchased by the Board at the rate of Rs. 25 per thousand with the exception of a small quantity supplied by one estate at Rs. 20. Including costs of transport, germination, packing, despatch etc. the Board's overall cost amounted to about Rs. 30/- per 1000 germinated seeds. The nominal price charged by the Board was half of this —Rs. 15 per thousand for quantities up to 4,000 seed supplied to any one party as already mentioned. At this rate the cost of seed sufficient to plant one acre, allowing 300 seeds to produce 220 to 250 stumped plants, amounts to Rs. 4-8-0.

The Establishment, Care and Maintenance of Seedling nurseries

A circular letter on the method of establishing clonal seedling nurseries, their care and maintenance, was issued by the Board to those who applied for seeds, sufficiently early, in order to enable them to prepare the nursery beds and keep them ready for planting. This circular letter has later been published in the Serial Pamphlet No. 5. It has been reported that the growth of Tj. 1 seedling in a number of nurseries established is not satisfactory. How far this is due to soil conditions and other factors has to be ascertained. Mean while those who have established seedling nurseries should pay particular attention regarding their care and maintenance, like weeding, watering during the dry season, manuring etc., in order to obtain good results.

IMPROVING THE QUALITY OF NATURAL RUBBER

By C. E. T. Mann,
Director, Rubber Research Institute of Malaya.

(Reprinted from Financial Times, July 31, 1950.)

The pattern of the application of science to the arts of producing natural rubber has been much the same in all the principal rubber producing countries in the East. Introduced in the first place by scientific men of vision, the development of *Hevea brasiliensis* as an economic plantation crop has been well served by science from the beginning.

It is convenient to divide the field of investigation broadly into two parts. The first part embraces all aspects of growing the tree, maintaining it in health and harvesting the crop as latex. The second part of the field concerns the conversion of latex into rubber in the various forms in which it is exported.

This brief survey would be incomplete without reference to the notable part played by planters themselves. Between the progressive planter and the research worker there has developed a cordial and fruitful co-operative relationship. As witness to this satisfactory state of affairs, the conduct of collective research at the Rubber Research Institute for the rubber industry of Malaya is now controlled by a Board of management containing five members chosen jointly by the estate associations.

Close Liaison

Many of the largest producing companies have also established their own scientific research units which maintain close liaison with the central research stations as well as undertaking independent research.

Finally, it is particularly important to record that from its earliest days, the rubber industry of Malaya has pursued a policy of free interchange of information with similar research organisations in other producing territories and a valuable measure of co-operation has been established.

This kind of liaison in the field of production research has never been closely formalised, but it has amply proved its value on many occasions. The proposals made in 1934 by the International Rubber Regulation Committee for the organisation and financing of consumption research came as a logical development of the policy of collective research that had already been adopted and successfully applied in production research by the industry in the East.

Two Objectives

The two main objectives of all our work in Malaya are reduction in the cost of the product, and improvement in the quality of the product.

Dealing first with research on the tree, selection and breeding of improved high-yielding planting material, including clones of bud-grafted trees and families of high yielding seedlings derived from them, are of first importance.

In 1930, an annual yield of about 500 lbs. of dry rubber from an acre planted with unselected seedling trees was held to be very satisfactory. In 1950, large areas planted with good proved clones are yielding well over 1000 lbs. an acre a year, and there are already many commercial plantings that have reached an annual yield of 2000 lbs. per acre.

Selection work continues confidently towards still higher yields. The value of this work in terms of cost of production and increased efficiency, as measured by output per unit of labour, need not be emphasised.

Next in order of importance is research into the technique of tapping and harvesting the crop. Modifications suited to different types of trees are being successfully applied both for normal operations and "slaughter tapping" prior to replacement.

The third principal subject of botanical investigation is the study of growth and yield of the rubber tree growing in association with other plants. By the adoption of a system of "hedge" planting for the rubber trees, it may prove feasible to cultivate a second valuable crop, cacao, for example, between the rubber rows.

Soil Classification

The second principal division of research on the tree embraces the special work of the soil scientists and their agricultural partners. A broad classification of soils in the rubber-growing areas of Malaya has been drawn up and, although this classification is by no means complete, it provides a sound basis for guidance in the solution of practical problems of manuring and cultivation.

The fertiliser requirements of rubber of different soil types have also been critically studied and the economic aspects of manuring of the rubber trees are continuously under review.

Additional investigations include the study of economic methods of weed control and the preparation of land for planting.

The third main division of research on the tree embraces the work of the plant pathologists, the mycologist and the entomologist. In common with most generalisations of its kind, the statement that "rubber is a hardy weed" is only true to a very limited extent, and if the annual loss of trees and rubber of Malayan estates and small holdings caused by root disease parasites and the fungi causing mouldy rot of the tapping panels, and other tree troubles, could be accurately assessed, the resulting loss in revenue to the industry would probably surprise those who still think disease a matter of minor importance.

It is known that strains of Hevea extremely resistant to leaf blight have been established in tropical America. Negotiations for exchange of high-yielding material developed at the R. R. I. in Malaya for these resistant strains are proceeding.

Research on latex and rubber commences with the flow of latex from the tree, and is continued throughout all phases of the product in its exportable forms. Close liaison is maintained between workers in Malaya and the United Kingdom, and staff exchanges and secondment take place as circumstances dictate.

In the post-war period, producers' research stations, alive to the threat to the natural rubber industry of the rival synthetic industry, have greatly increased their efforts in the field of research on the product.

The objectives of all investigations in this field are improvement in the qualities of natural rubber; by increasing knowledge of its chemical and physical properties to increase the range of its usage; and finally, so to improve the manner of its presentation to the user that its supremacy in the manufacturing field will be maintained.

Presentation

Currently, the more immediate interest of the industry is centred upon improving the quality of the product and the manner of its presentation to the consumer.

Variability of natural rubber in those properties of greatest importance in manufacturing processes has been a constant source of complaint from manufacturers, and research by the natural rubber producers' organisations confirms that the consumers' criticism of the variable quality of natural rubber is generally well founded.

Lacking means to eliminate variability, the next best course is to label it, and the attempt is now being made to do this on lines first advocated in 1949 by the French producers' organisations for rubber research, the Institut Francais du Caoutchouc and the Institut de Recherches sur le Caoutchouc en Indochine, as the basis of a possible technical grading scheme for rubber.

The properties to be measured are generally accepted as satisfactory indications of the qualities commonly termed plasticity and rate of cure by the manufacturers' technologists. Although a survey of Malayan rubber, now in progress, is not yet complete, it can now be said that Malayan sheet rubber can probably be classified into nine groups.

Uniform Standards

The producers' proposals to market rubber on the basis of a technical specification (at no additional cost to the consumer in the first instance) was considered by the International Rubber Study Group at Brussels in May, 1950, and generally welcomed. The International Rubber Research Board was asked to co-ordinate the plans of producers in the different territories in order to ensure the adoption of uniform

procedures, and standards, and the Rubber Manufacturers' Association of New York agreed to co-operate.

It is the view of the research organisations that specification grading is to be regarded as a first step towards better evaluation and presentation of natural rubber. The conclusion is inescapable that in order to produce a first-class uniform product centralised preparation in large factories under adequate technical supervision is the logical solution.

New procedures for the development of improved and special rubbers include investigation of methods of preparation of rubber powder suitable for use in road surface mixtures, and machinery for the preparation of crumb rubbers. To provide the necessary facilities for the conduct of these investigations on pilot plant scale, accommodation and equipment are to be provided in a large prototype central factory in the course of erection on the institute's experimental station.

Altogether, therefore, it is clear that the industry is doing a great deal to improve its product and to minimise the problems of its customers, the rubber manufacturers.

TEMPORARY PACKING SPECIFICATIONS FOR CRUDE RUBBER

(Adopted by the Rubber Manufacturers Association, Inc., 444 Madison Avenue, New York, N. Y., and Endorsed by Rubber Trade Association of New York, Inc., to become effective at earliest possible date but not later than January 1, 1951. These Temporary Packing Specifications for Crude Rubber supersede those which became effective October 1, 1950.)

Temporary Packing Specifications for rubber covered bales of ribbed smoked sheets

(1) The maximum weight of each bale shall be 250 pounds net per five cubic feet outside measurements.

(2) Each bale must be wrapped on all sides and corners with equal or higher quality rubber. Double wrapper sheets must be used if wrapper sheets contain holes. No bands shall be placed under wrapper sheets.

(3) To overcome adhesion of bales in transit and also provide proper background for stencilling of coloured shipping marks, the outside of the wrapper sheet must be completely and thoroughly painted on all six sides with a suitable talc solution that is easily dispersed upon mastication and has no adverse effect upon the quality of manufactured products. (Such as recommended by the Rubber Research Institute of Malaya, the Indonesian Rubber Research Institute (INIRO) and similar organizations in other producing countries).

Any talc used in the coating or in any operation having to do with the packing and shipping of rubber must meet the following talc specifications:

One hundred per cent penetration through standard 100 mesh or ninety-five per cent through 300 mesh screen.

(4) The following coating solution has been found satisfactory and is acceptable:

Coating Mixture

4 gal. Mineral Turpentine (obtainable from Leading Oil Companies)

16 lbs. Gum solution (See below)

48 lbs. fine Talcum (Enough for coating approximately 75 bales).

Gum Solution

½ lb. Pale Crepe cuttings (or clean RSS)

1 gal. Mineral Turpentine.

(Leave for 24 hours, then add ½ gal. Mineral Turpentine).

(5) Grade and/or identification marks must appear on two sides of bales in minimum 8 inch characters; weight must appear in minimum 4 inch numerals, and country of origin must be shown.

Shipping marks must be stencilled on bales. The following solution is required:—

Dissolve 2 lbs. rubber in 7 gallons of kerosene. By cutting the rubber into half inch squares, it will dissolve more quickly. This forms a basic solution into which dyes or pigments are introduced at time of stencilling. (Carbon black must not be used.)

Temporary Packing Specifications for Rubber Manufacturers' Association. Crude Rubber Types other than Ribbed Smoked Sheets

1. No. 1-X Thin Pale Latex Crepe.
   No. 1 Thin Pale Latex Crepe.
   No. 2 Thin Pale Latex Crepe.

(1) The maximum weight of the rubber in each bale shall be 224 lbs. net per five cubic feet outside measurements.

(2) Rubber covered bales shall be acceptable. Each bale must be wrapped on all sides and corners with equal or higher quality pale crepe. Multiple plies of pale crepe shall be used in the wrapper so as to insure that the interior rubber shall be protected.

(3) To overcome adhesion of bales in transit, the outside of the wrapper sheet must either be heavily talced or painted with a talc solution. The same talc specification shall apply as is covered under the Ribbed Smoked Sheet Specification.

(4) Metal bands outside the wrapper sheet are optional but wire shall not be used.

2. No. 1-X Thick Pale Latex Crepe.

No. 1 Thick Pale Latex Crepe.

No. 2 Thick Palish Latex Crepe.

(1) Must be packed in burlap covered bales. It is preferred that bale be wrapped on all sides and corners with equal quality thin or thick crepe and burlap covering then applied.

(2) The maximum weight of the rubber in each bale shall be 224 lbs. net per five cubic feet outside measurements.

(3) Before covering with burlap, each bale shall be properly strapped by using not less than three iron bands of a minimum width of $\frac{5}{8}$ inches. These bands should preferably be galvanised. If interior rubber wrapping is used, the bands must be placed outside the rubber wrapping and under the burlap.

(4) Nothing inferior to new 12 ounce hessians shall be used for covering. Secondhand rice or sugar bags, without holes or patches are also satisfactory. All burlap must first be liberally coated with proper mixture of sago flour, water and silicate of soda to prevent the covering from adhering to the rubber. A generous application of this solution must be given to insure proper absorption.

The burlap should be thoroughly dried before applying it to the rubber.

3. No. 4 Thin Brown Remilled Crepe.

No. 1 Roll Brown or Flat Bark Crepe.

Must be packed according to Rubber Manufacturers' Association Packing Specifications dated August 1, 1938, except that clean used hessian (such as, used rice bags) is acceptable if properly coated according to 1938 specifications, and bands are optional.

4. Packing of other grades is temporarily acceptable, providing:

(a) maximum net weight per bale does not exceed 224 lbs. per five cubic feet outside measurements.

(b) i. Two burlap patches or thin light coloured crude rubber patches of suitable size are placed under strapping on opposite sides of bale *or*

(b) ii. Each bale is wrapped on all sides and corners with thin pale latex crepe or thin light brown crepe of equal or higher quality. No bands shall be placed under the wrapper sheets.

(c) Outside of bale is thoroughly talced, or preferably coated with suitable talc solution.

(d) Identification marks appear on both patches in minimum 8 inch characters, weights appear in minimum 4 inch numeral and country of origin must be shown.

NEWS AND ANNOUNCEMENTS

1. DISTRIBUTION OF SELECTED CLONAL SEED DURING THE FORTHCOMING SEEDING SEASON, 1951.

The Indian Rubber Board has decided to distribute during the ensuing seeding season selected clonal seeds to small holders and also to estates for experimental planting with a view to encourage the use of improved planting material. A reduced price of Rs. 15 to 20 per thousand seed, depending on the actual cost, will be charged for quantities up to 2,500 seeds which is the maximum limit for supply to any one party or planting company at the reduced rate. An additional maximum quantity of 2,500 seeds for each party may be supplied at actual cost, if possible. Rubber growers who require clonal seeds within the above limits during the current year are requested to register their requirements with the Indian Rubber Board before the 15th May 1951.

Those who require larger quantities of selected clonal rubber seed than that mentioned above, are advised to buy their requirements of seeds direct from the suppliers. Information relating to names of suppliers, field from which seed is to be collected, etc., can be had on request, from this Board. Training in the selection of particular clonal seeds by seed-characters and instructions for laying down germinating beds etc. can be given to the estate staff concerned at the Board's office at Kottayam, if required. If there is any doubt about the identity of the seeds purchased, samples may be sent to this Board for checking or they may be checked up with type samples which may be obtained from the Board and kept ready for the purpose.

Applications for seed under the above scheme should be addressed to the Secretary, Indian Rubber Board, Kottayam.

2. RUBBER CONTROL

Government of India
Ministry of Industry and Supply

NOTIFICATION

New Delhi, the 1st February 1951

No. PC-16 (1)/50. In exercise of the powers conferred by clause (c) of section 13 of the Supply and Prices of Goods Act, 1950 (LXX of 1950) and other powers enabling it in this behalf, the Central Government hereby directs that no raw rubber other than sole crepe rubber shall be transported from the State of Travancore-Cochin by rail, road, air or water to any destination outside the said state except under a permit issued by the Rubber Controller, Kottayam, (South India).

(*Sd.*) K. RAM
Deputy Secretary to the Govt. of India.

3. INQUIRY INTO RAW RUBBER PRICES BY THE INDIAN TARIFF BOARD

The Indian Rubber Board at its meeting held on the 7th October 1950 resolved that the case for a fair price for raw rubber should be referred to the Indian Tariff Board. The Government of India carefully examined this matter and considered that there was a case for referring the question of price to the Tariff Board for investigation. The Tariff Board was accordingly requested to conduct necessary enquiries about the cost of production of rubber and submit their recommendation to Government as early as possible. The Indian Rubber Board subsequently suggested that the Tariff Board's enquiry should be more comprehensive covering the whole field of protection to rubber for the speedy development of the industry. The Government of India thereupon decided that the Tariff Board should extend their enquiry and make recommendations to Government in regard to the following matters :—

(a) Whether the industry is established and conducted on sound business lines.

(b) Whether having regard to the natural or economic advantages enjoyed by the industry and its actual or probable costs of production it is likely within a reasonable period of time to develop sufficiently to be able to carry on without protection or State assistance.

(c) Whether it is feasible to remove restrictions on import of raw rubber and levy an import duty so that imported raw rubber will not sell at a price less than the fair price fixed for the Indian Rubber.

(d) Whether any special development fund should be created for the development of the industry; and if so, how that fund should be raised.

In connection with this inquiry a few representative rubber estates' accounts were examined by the Cost Accounts Officer of the Indian Tariff Board for ascertaining the cost of production of rubber. Later Dr. H. L. Dey and Dr. B. V. Narayanaswami Naidu, President and one of the Members respectively, of the Indian Tariff Board, came to Kottayam and visited some estates and small holdings on the 9th February, 1951, in order to obtain first-hand knowledge of the conditions obtaining in the rubber plantation industry. On the 10th they met the representatives of the Indian Rubber Board, the Association of Planters of Travancore, the Rubber Growers' Association of India, the United Planters' Association of Southern India, the Travancore-Cochin Government, and a few prominent individuals at the Government House, Kottayam, to ascertain their views on the question under reference to the Indian Tariff Board.

The Indian Tariff Board held a public enquiry on the 19th and 20th February 1951 at Bombay at which the representatives of both the rubber growers and the rubber goods manufacturers were present. The report of the Indian Tariff Board will be considered by the Government of India and a final decision in the matter is expected to be taken by them very early.

4. PRICE OF RAW RUBBER

Government of India
Ministry of Commerce and Industry

New Delhi, the 7th March 1951.

NOTIFICATION

(Rubber Control)

No. 19 (1)—T & P/51. In exercise of the powers conferred by Sub-section (1) of Section 13 of the Rubber (Production and Marketing) Act, 1947 (XXIV of 1947), and in supersession of the notification of the Government of India in the Ministry of Industry and Supply. No. 19 (2)—1 (6)/50, dated the 25th July 1950, the Central Government, after consulting the Rubber Price Advisory Committee, hereby fixes with effect from the 7th March 1951, for all classes of business the following

maximum and minimum prices for the various grades and qualities of rubber mentioned below :—

Grade and quality of rubber		F. O. B. Cochin for 100 lbs. Maximum price			Minimum price		
		Rs.	as.	p.	Rs.	as.	p.
Group 1	R. M. A. IX	122	8	0	121	8	0
	R. M. A. 1.	122	8	0	121	8	0
Group 2	R. M. A. 2.	121	0	0	120	0	0
	R. M. A. 3.	119	8	0	118	8	0
	Cuttings No. 1	112	0	0	111	0	0
Group 3	R. M. A. 4.	116	0	0	115	0	0
	R. M. A. 5.	112	0	0	111	0	0
	Cuttings No. 2	106	0	0	105	0	0
Group 4	Precoagulated Crepe	128	0	0	127	0	0
	Pale Latex Crepe IX	126	0	0	125	0	0
	Pale Latex Crepe 1	124	0	0	123	0	0
	Pale Latex Crepe 2	123	0	0	122	0	0
	Pale Latex Crepe 3 FAQ	122	0	0	121	0	0
Group 5	Estate Brown Crepe IX	114	0	0	113	0	0
	Estate Brown Crepe 2X	111	0	0	110	0	0
	Smoked Blanket	114	0	0	113	0	0
	Remilled Crepe 2	106	8	0	105	8	0
Group 6	Estate Brown Crepe 3X	103	0	0	102	0	0
	Remilled Crepe 3	101	0	0	100	0	0
	Remilled Crepe 4	95	8	0	94	8	0
Group 7	Flat Bark	87	0	0	86	0	0
35% Normal Latex (excluding cost of container)		123	8	0 *plus* a premium of Rs. 17-8 0 per 100 lbs of D. R. C.	122	8	0 *plus* a premium of Rs. 17-8-0 per 100 lbs. of D. R. C.
50% to 55% concentrated preserved latex (excluding cost of container)		123	8	0 *plus* a premium of Rs. 43 per 100 lbs. of D. R. C.	122	8	0 *plus* a premium of Rs. 43 per 100 lbs. of D. R. C.

(Sd.) S. A. VENKATARAMAN,
Secretary to the Government of India.

5. IRON AND STEEL MATERIALS REQUIRED BY RUBBER ESTATES

The Iron & Steel Controller, Calcutta, makes allotments of iron and steel materials to the rubber plantation industry every quarter and issues quota certificates to parties on the recommendations made by the Rubber Production Commissioner. Such recommendations have to be made for each quarter before the due date (which is invariably about four months before the beginning of the quarter concerned) fixed by the Iron & Steel Controller in respect of each period. For example, we have just now sent our recommendations for Period III/51, i. e., the third quarter of the current year. All demands received from rubber growers from time to time are, therefore, collected and a consolidated list sent once every quarter before the due date with suitable recommendations. Rubber growers who require Iron and Steel materials for new constructions and extensions or for maintenance and repairs to existing buildings on the *rubber estates* may send their applications in the prescribed form to the Indian Rubber Board *after getting the applications duly certified by a qualified Engineer*. Copies of the prescribed application will be supplied by this Board on request.

The Government of India, while agreeing to release Iron and Steel materials to rubber growers, desired that this Board should ensure that the materials released are used only for the purpose for which applications were made and duly recommended. This Board's officers will, therefore, be visiting the estates concerned for this purpose from time to time.

INDIAN RUBBER STATISTICS—1950

The statistics of the Indian Rubber Industry, as at the end of 1950, given in the following pages, have been compiled from the latest returns received by the Indian Rubber Board from estates, small-holders and rubber manufacturers. Some units which had not registered before have now registered their estate or holding and necessary corrections and adjustments have been made in the statistics. Owing to this, differences in figures of planted area between the 1950 and the previously published statistics may be noticed. The 1950 statistics may be considered as revised and more correct.

INDIAN RUBBER STATISTICS

TABLE 1

Total planted area and total estimated tappable area at the end of 1950 in acres.

Planting Material	Estates (100 acres & above)	Small Holdings (Below 100 acres)	Total planted area	Total tappable area
(1) Ordinary seedling rubber	74,395	63,838	138,233	116,777
(2) Clonal seedling rubber	7,284	1,398	8,682	3,753
(3) Bud-grafted rubber	21,539	2,053	23,592	16,410
Total	103,218	67,289	170,507	136,940

TABLE 2

Geographical distribution of Planted Area in India

Travancore-Cochin State :—		
Travancore	122,448	acres
Cochin	13,813	,,
Mysore State	396	,,
Coorg State	3,196	,,
Madras State :—		
Malabar	27,734	,,
Canara	410	,,
Nilgiris	861	,,
Coimbatore	644	,,
Salem	132	,,
Madura	407	,,
Andamans	407	,,
Assam	50	,,
Bengal	9	,,
Total	170,507	acres

TABLE 3

Size of Small Holdings and Estates

Size class	No. of units	Area in acres	Percent of total area
(1) Small Holdings :—			
Under 1 acre	2,423	1,389	0·8
Of and over 1 acre and under 5 acres	8,291	18,182	10·7
Of and over 5 acres and under 10 acres	1,459	9,702	5·7
Of and over 10 acres and under 50 acres	1,299	24,638	14·4
Of and over 50 acres and under 100 acres	199	13,378	7·8
Total small holdings: —	13,671	67,289	39·4
(2) Estates :—			
Of and over 100 acres and under 500 acres	201	39,716	23·3
Of and over 500 acres and under 1000 acres	29	20,405	12·0
Of and over 1000 acres and under 1500 acres	18	21,762	12·8
Of and over 1500 acres and under 2000 acres	5	8,941	5·2
Of and over 2000 acres	5	12,394	7·3
Total Estates :—	258	103,218	60·6
Grand Total :—	13,929	170,507	100·0

Average size of small holdings : 4·9 acres
Average size of estates : 400·1 acres

TABLE 4

Area in acres of New Planting and Replanting 1938—1950 and Planting Material Used

Year	New Planting				Replanting				Grand total
	Ordinary seedling	Clonal seedling	Bud grafts	Total	Ordinary seedling	Clonal seedling	Bud grafts	Total	
1938	485	5	486	976	5	...	791	796	1772
1939	1078	527	1465	3070	83	...	865	948	4018
1940	1202	507	1104	2813	106	...	792	898	3711
1941	719	31	110	860	...	56	1200	1256	2116
1942	2993	449	363	3805	219	60	1899	2178	5983
1943	10052	1790	2657	14499	192	...	113	305	14804
1944	8285	1095	1042	10422	527	...	405	932	11354
1945	6332	2113	566	9011	94	67	...	161	9172
1946	2768	638	375	3781	234	15	172	421	4202
1947	1331	384	466	2181	77	...	428	505	2686
1948	414	72	149	635	200	71	365	636	1271
1949	511	194	88	793	49	49	202	300	1093
1950	85	31	...	116	549	200	154	903	1019
Total	36255	7836	8871	52962	2385	518	7386	10289	63201

TABLE 5

Area of Replanting on Estates and Small Holdings in acres, as on 31-12-1950

Year	Estates				Small Holdings				Total estates & small holdings
	Ordinary seedling	Clonal seedling	Budgrafts	Total	Ordinary seedling	Clonal seedling	Budgrafts	Total	
Replanted earlier than 1938	9	...	1963	1972	8	...	...	8	1980
,, during 1938	...	...	791	791	5	...	...	5	796
,, ,, 1939	66	...	840	906	17	...	25	42	948
,, ,, 1940	86	...	792	878	20	...	...	20	898
,, ,, 1941	...	56	1190	1246	...	...	10	10	1256
,, ,, 1942	189	60	1899	2148	30	...	...	30	2178
,, ,, 1943	142	...	113	255	50	...	...	50	305
,, ,, 1944	527	...	405	932	...	...	...	...	932
,, ,, 1945	81	67	...	148	13	...	...	13	161
,, ,, 1946	234	15	172	421	...	...	...	...	421
,, ,, 1947	77	...	428	505	...	...	...	...	505
,, ,, 1948	189	71	365	625	11	...	...	11	636
,, ,, 1949	47	49	202	298	2	...	...	2	300
,, ,, 1950	549	192	153	894	...	8	1	9	903
Total	2196	510	9313	12019	156	8	36	200	12219

TABLE 6

Production, dry weight in tons, 1941—1950

Year	Estates of & above 100 acres	Small holdings (below 100 acres)	Total
1941	10,861	5,434	16,295
1942	11,050	5,529	16,579
1943	10,645	5,984	16,629
1944	11,198	5,976	17,174
1945	10,839	5,238	16,077
1946	10,493	5,179	15,672
1947	10,988	5,461	16,449
1948	10,951	4,471	15,422
1949	11,448	4,139	15,587
1950	11,431	4,168	15,599

TABLE 7

Monthly Production, dry weight in tons, 1948—1950

Months	1948	1949	1950
January	1425	1326	1291
February	270	257	208
March	956	798	988
April	1498	1563	1640
May	1646	1240	1450
June	694	854	836
July	844	904	758
August	1068	1245	1053
September	1646	1410	1414
October	1796	1944	1987
November	1742	2011	1975
December	1837	2035	2049
Total	15422	15587	15599

TABLE 8

Consumption of Raw Rubber (indigenous and imported) by Rubber Goods Manufacturers (Tons)

Month	1948	1949	1950
January	1587	1548	1162
February	1494	1414	1295
March	1587	1284	1320
April	1668	1981	1435
May	1432	1847	1372
June	1875	1770	1517
July	1801	1785	1800
August	1902	1819	1670
September	1753	1638	1506
October	1109	1068	1253
November	1700	1697	1737
December	1811	1341	1668
Total	19719	19192	17735

TABLE 9

Imports of Raw Rubber during 1948—1950 (Tons)

Months	1948	1949	1950
January	...	501	339
February	...	354	41
March	...	954	44
April	...	691	...
May	...	9	132
June	315	71	44
July	705	...	...
August	444	...	...
September	941	3	...
October	649	2	75
November	595	66	175
December	684	116	282
Total :—	4333	2767	1082

TABLE 10

Production, Consumption and Stocks of Indigenous Rubber, 1950, (Tons)

Group	Production	Consumption of indigenous production by local manufacturers	Stocks with estates and dealers as on 31-12-'50	Stocks in transit sold to manufacturers as on 31-12-'50	Stocks of indigenous rubber with manufacturers as on 31-12-'50
Group 1	5934	5218	1455	682	251
Group 2	3127	4013	601	140	20
Group 3	1276	1944	244	73	146
Group 4	1151	842	333	63	114
Group 5	623	1408	245	36	13
Group 6	482	1370	236	217	59
Group 7	62	89	45	29	7
Scrap Grades	1551	264	445	25	2
Latex (D. R. C.)	870	428	284	1	99
Sole Crepe	523	78	183	...	19
Estimated unspecified	...	869 *	...	...	125*
Total :—	15599	16553	4076	1266	855

*Estimated consumption by and stocks with some manufacturers from whom returns have not been received.

Note: —The excess consumption of indigenous rubber over production in 1950 has been met out of opening stock for the year.

(Continuation from cover 2nd page)

Mr. Lalit Mohan Jamnadas	Nominated by the Indian Rubber Industries Association to represent manufacturers.
„ C. E. Bharathan,	Nominated by the Central Government to represent labour.
„ K. V. Mathew (Mundakayam)	
„ K. Karunakaran, M. L. A.	

The Rubber Production Commissioner (ex-officio)

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(3) „ M. C. Chandy,
(4) Sri. F. Hawkings
(5) „ P. Kurian John,
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(7) The Director of Agriculture, Travancore-Cochin State,
(8) The Rubber Production Commissioner (Ex-officio)

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(3) Sri. P. Kurian John,
(4) „ M. Sankara Menon,
(5) The Rubber Production Commissioner (Ex-officio), Editor.

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THE INDIAN RUBBER BOARD BULLETIN

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CONTENTS

Government of India, Ministry of Commerce and Industry, Notification, dated 13th August 1951.

NOTIFICATION

No. 16 (3)—BC/51. In exercise of the powers conferred by clause (c) of section 13 of the Supply and Prices of Goods Act, 1950 (LXX of 1950) and in supersession of the notification of the Government of India in the Ministry of Commerce and Industry No. S. R. O. 170 dated 1st February 1951, the Central Government hereby directs that no raw rubber other than sole crepe rubber and latex shall be transported from the State of Travancore-Cochin and the District of Malabar in the State of Madras by rail, road, air or water to any destination outside the said State or as the case may be, the said District, except under a permit issued by the Rubber Controller, Kottayam (South India).

Provided that nothing in this notification shall apply to the movement of raw rubber other than sole crepe rubber and latex between the State of Travancore-Cochin and the District of Malabar in the State of Madras.

(*Sd.*) S. K. DATTA,
Deputy Secretary to the Govt. of India.

EDITORIAL COMMITTEE

(1) Mr. K. Karunakaran, (3) Mr. P. Kurian John,
(2) Mr. A. V. George, (4) Mr. M. Sankara Menon,
(5) Mr. K. N. Kaimal, (*Editor.*)

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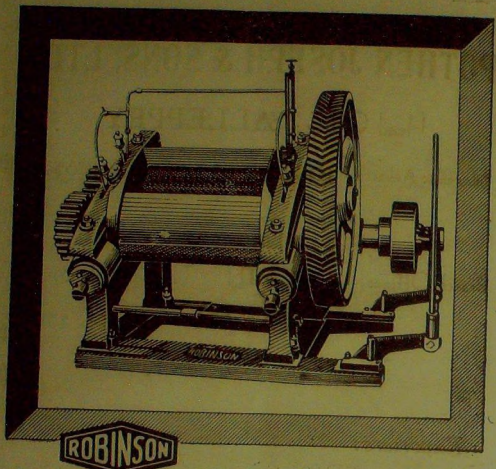

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THE BARK OF THE MATURE RUBBER TREE

The Structure and Functions of the Principal Tissues

BY

K. N. KAIMAL.

The term bark is generally used to mean the outer covering of the root, the stem and branches of woody plants which lie outside the *cambium*. It is also being used by some authors in a more restricted sense, to mean the thick cork layers on the surface of trees. For the purpose of this article the cork, the *cambium* and all the tissues which lie between them are included under this term.

A three dimensional diagram of a portion of the bark of a mature rubber tree is given in Fig. 1. Drawings of microscopic sections cut along the three dimensions—transverse or cross section, radial-longitudinal section and tangential section—are appropriately combined to produce this diagram.

In the picture of the bark, Fig. 1, three distinct zones may easily be noticed. They are (1) a thick layer on the outer surface called 'cork', (2) a wider zone occupying the greater proportion of the bark consisting of hard stony tissues called the 'hard bark' and (3) an inner zone of softer tissues extending up to the wood, called 'soft bark.' With this rough division of the mature bark into three parts, the structure and main functions of the important tissues which constitute them may be briefly described.

1. THE CORK

The dark, brown, elastic, spongy protective cover formed on the surface of stems and branches of trees is called the cork. It begins to develop on the stems of rubber plants at a very early stage. Rudiments of cork first appear on the older portions of the stem near the ground as small brown spots and spreads up to younger parts as the plant grows, forming a thick compact layer and replacing the *epidermis* or skin. It is formed as a result of the activity of a secondary *meristem* (dividing cells) called the *Cork cambium* (cork forming dividing cells) which is situated along the outer boundary of the hard bark. By tangential

cell division, the *cork cambium* produces a number of new cells. The new cells situated towards the outside, deposit and become filled with a corky substance. They die off as a result of this. These dead cells collectively form the cork tissue. The new cells situated towards the inside transform themselves into hard stone cells. The middle cells of the *cork cambium* remain alive and repeat the process of cell division forming additional layers of cork and stone cells. The older outer layers of cork are not strong enough to withstand the pressure of this new tissue as well as the growth in circumference or girth of the trees; consequently they are ruptured and later torn off and replaced by newly formed cork.

On mature rubber trees the stem, branches and exposed roots are covered by the cork tissue. Seedling trees are characterised by thick layers of cork on the surface of the stems. Budded trees, on the other hand, invariably possess only a comparatively thinner layer of cork and hence have smoother surface. After a rain, therefore, stems of seedling trees with thick layers of cork, particularly in the case of older trees, dry up slower than budded trees.

Cork is a non-conductor of heat and cold. The surface cover of cork, therefore, protects the inner tissues against severe fluctuations of atmospheric temperature. It also protects the inner tissues against external mechanical damage to a certain extent.

2. THE HARD BARK

Stone Cells

In Fig. 1 nearly two thirds of the total thickness of the bark lying inside the cork layer is characterised by hard, brittle, yellowish stony elements (coloured black in the figure) embedded in a ground tissue of soft cells called *Parenchymatous* cells. This region is called the hard bark and the stony elements, stone cells. When ordinary *Parenchymatous* cells become old they deposit a substance called lignin which gradually fills them up, and render them hard and brittle. Stone cells are evolved in this manner. Isolated cells or groups of cells may thus turn out as stone cells. The surrounding *Parenchymatous* cells follow suit and the cluster of stone cells thus expand towards the centre. Near the border line between the cork and hard bark may be noticed an unbroken, continuous ring of stone cells. This is called the *Sclerenchyma* ring.

The function of the stone cells is purely mechanical. They render the bark hard and rigid and, like a cylinder of strong brickwork, afford protection to the soft inner tissues against mechanical damage.

From the economic point of view, stone cells are not only useless elements in the bark but are also undesirable because the development of this tissue distorts and breaks up the latex vessels in the hard bark making them rather unproductive. This may be noticed in Fig. 1. There is much variation in the occurrence of stone cells and consequently in the thickness of hard bark in seedling trees of mixed origin.

Some trees are characterised by fewer stone cells and a thin zone of hard bark. At the other extreme there are trees with very hard bark, the stone cells occurring to a great depth close to the *cambium*. Soft bark in this case will be very thin and functional latex vessels very few. Tapping of such trees will be found rather difficult and yield of latex poor. In the bark of budgrafted trees of a clone, variation in the occurrence of stone cells is not so great as in a population of seedling trees. But the bark is invariably harder and contains more stone cells than are usually found in the bark of seedling trees of the same age. Variations in the hardness of bark, however, do occur between buddings of different clones, depending on this character of the mother tree, for, in vegetative propagation most of the characters of the mother tree are transmitted to the 'offsprings.' When a tapping task consists of buddings of different clones or a mixed stand of seedlings and buddings, the tapper will usually tap the seedlings too deep causing wounds or tap the buddings too shallow, in which case, yield from them will be low. This factor should receive due consideration when allotting tapping task. It should not consist of a mixture of seedling trees and budded trees. Owing to the greater hardness of the bark of buddings, the knives used for tapping them require more frequent sharpening.

Other tissues which usually occur in the hard bark consist of ordinary *Parenchymatous* cells, sieve tubes, *medullary* rays and latex vessels, most of which have become old and disorganised by the development of stone cells. They are present in their normal form in the soft bark and so are described under that heading below.

3. THE SOFT BARK

The zone of bark lying between the hard bark and the wood (see Fig. 1) is called the soft bark. Small stone cells in the initial stages of their development are invariably present near the outer limits of the soft bark. The more important tissues which constitute the bulk of the soft bark are described below.

Parenchyma tissue

The fundamental cellular tissue of plants is called the Parenchyma. In fact all the tissues of the bark originate first as *Parenchymatous* cells and sooner or later differentiate themselves into specialised cells of the various tissues like the latex vessels, sieve tubes etc., for performing different functions. A fairly large number of the *parenchymatous* cells, however, do not generally undergo any such differentiation but remain so until they become old and are transformed into stone cells. They form the ground tissue in which the cells of the other tissues are embedded.

Parenchymatous cells are more or less round in shape. The cell walls are moderately thick, particularly in the hard bark and are permeable, i. e., allow diffusion of cell sap from cell to cell. The inside walls of the cells are lined with protoplasm which is characteristic of all living

cells These cells may contain a variety of substances particularly starch and protein. In the bark they function mainly as storage cells for plant food materials.

Sieve tubes

Sieve tubes are long, thin walled, cylinders formed by the longitudinal fusion of vertical rows of cells. They are divided into narrow, long compartments by oblique partition walls. The partition walls are perforated and sieve-like in function and are called sieve plates. The name sieve tube is derived from this. The tubes are lined inside with a thin layer of protoplasm which, passing through the perforations of the sieve plates, maintain a living connection throughout the entire length of the tube. They are embedded in the ground tissue of thin walled *parenchymatous* cells and latex vessels in the soft bark. The older sieve tubes situated in the hard bark are invariably disorganised by the development of stone cells which crush them or distort them rendering them functionless. It is rather difficult to distinguish the older sieve tubes in the hard bark from the ordinary *parenchymatous* cells.

The main function of the sieve tubes is the transportation of plant food materials manufactured in the leaves of the tree down to all parts of it in a downward direction like a channel. Transport of it in a horizontal direction for supply to other tissues is accomplished by another tissue called the *medullary rays* which is described in another paragraph. Blocking of all the sieve tubes of the tree as by ringing the bark of the trunk, may affect the growth of the tree or result in its death. In this case the downward movement of food materials stops at the upper part of the ring. The parts below the ring begin to starve and subsequently cease to grow and sooner or later the tree may die off. The swelling which usually develops above the ring of ringed plants is caused by the blocking of the passage of food materials and their accumulation in that region.

In normal tapping a large number of sieve tubes are shaved off and free passage of food materials down the cut is interfered with. But the tapping knife does not usually penetrate the whole depth of the soft bark. About 1 to 1½ mm. of soft bark outside the *cambium* is left untapped and the sieve tubes in that zone function and prevent complete blocking of the passage of food materials to the lower parts of the tapping cut. Tapping deep to the *cambium*, besides causing 'wounds', would stop the flow of it downwards on the side of the tapping panel. A proportion of the contents of sieve tubes called the cell sap, exudes and flows with the latex following tapping of the bark. This accounts for some of the non-rubber constituents of fresh latex.

Medullary rays

The narrow rows of cells radiating from the outer limit of the pith in the centre and traversing the wood and bark of plants are called *medullary rays*. *Medullary rays* as they occur in the bark of the rubber trees are shown in Fig. 1. Each ray is composed usually of two

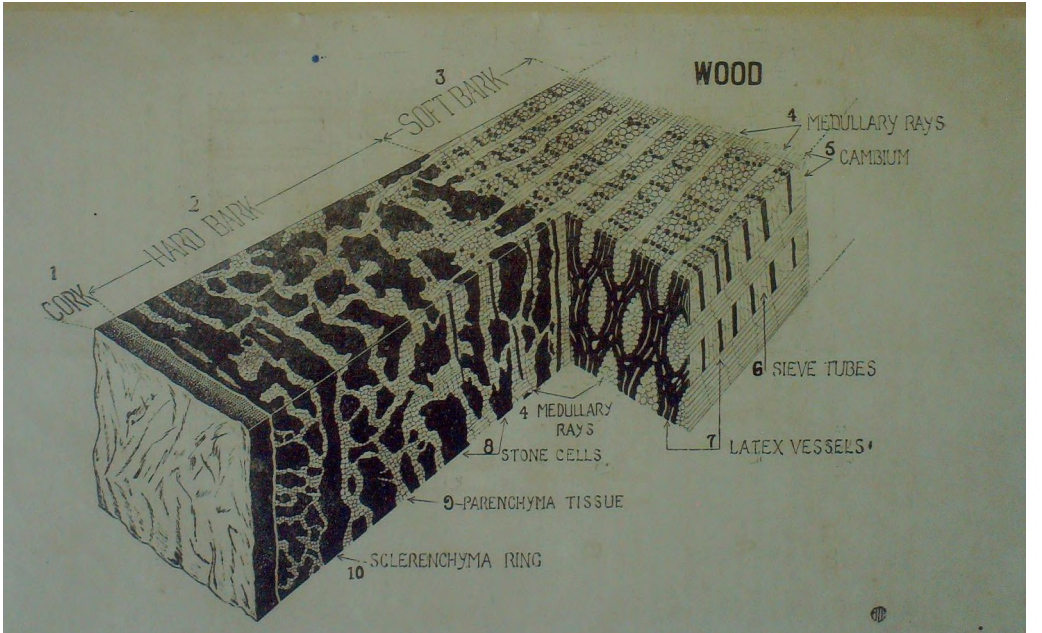

Fig. 1. Three Dimensional Diagram of the structure of the Bark of the Rubber Tree (*Hevea brasiliensis*).

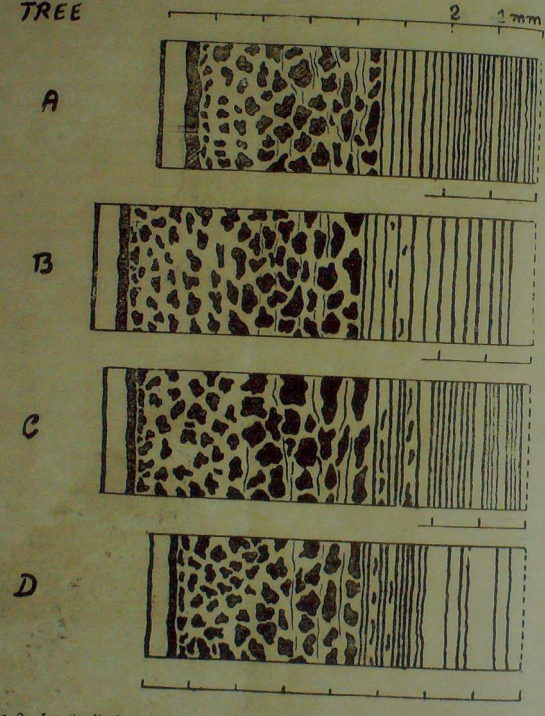

Fig. 2. Longitudinal section of the Bark of four Rubber Trees showing variation in the arrangement of latex vessel rows.

to three rows of elongated cells in cross section. They have thin cell walls through which fluid substances may diffuse into neighbouring cells and are lined with living protoplasm.

While all the other tissues of the bark are constructed in a vertical direction the *medullary rays* alone run in a radial-horizontal direction. How the sieve tubes serve to transport food materials down in the vertical direction has already been explained. Tissues situated on both sides, sometimes several inches or feet away from them, have to be supplied with food materials. This is accomplished by the *medullary rays*, their construction and course being ideally suited for the purpose. Food materials in solution diffuse from the sieve tubes into *medullary ray* cells which in turn transport it in the radial-horizontal direction and supply the tissues which lie along their course. The *medullary rays* of the wood are not connected with those of the bark by similar cells in the *cambium*. Here the contents of the *medullary rays* of the bark easily diffuse into the delicate thin walled *cambial* cells which, after supplying the requirements of this tissue, diffuse into the *medullary rays* of the wood through the cells lying in contact with them. The cells of the *cambium* lying between the *medullary rays* of the bark and the wood thus act like a bridge or connecting link, between the bark and the wood. Another important function of the *medullary rays* is the distribution, in a similar manner, of water which is absorbed by roots and carried in the upward direction by the new wood layers situated immediately inside the *cambium*.

The cambium

Plant tissues are classified into two main groups according to their function in the life of the plant :—" meristematic " or formative tissues, and ' permanent tissues '. Tissues composed of cells which are capable of division and formation of new cells under normal conditions, like the *cork cambium* mentioned earlier, are called *meristem* tissues. The cells which constitute this tissue are called *meristematic* or dividing cells. Permanent tissues are composed of cells which are produced by the division of *meristematic* cells and have assumed the form and function they are destined to take. These cells are not capable of further division under normal conditions. The tissues described hitherto, dead or living, with the exception of the *cork cambium*, are all permanent tissues.

The *meristems* or formative tissues are classified as primary *meristem* and secondary *meristem*. The primary *meristems* are localised and are situated at the growing points of shoots and roots. They are responsible for the growth in length of the shoots and roots of plants. The secondary meristem is called the ' *Cambium* ' and it is responsible for the secondary thickening or growth in girth of woody plants.

The cells of the *cambium* are extremely thin walled and contain abundant protoplasm. They have the shape of elongated, flattened prisms. They form a thin layer of varying depth between the wood and

the permanent tissues of the soft bark. In cross sections these cells lie in radial rows parallel to the line of the wood surface.

A middle layer of cells in the *cambium* undergoes repeated tangential cell division by the formation of tangential walls in them. This process is repeated continuously and new cells are cut off both towards the wood and the soft bark. These cells ultimately develop and differentiate themselves into permanent tissues of the wood and bark respectively. While this is the case with evergreen trees which go on growing continuously it is different with the *Hevea* rubber tree.

In the case of the rubber tree such cell division or *cambial* activity occurs only periodically. The cells of the *cambium* undergo active division as described above for a few days producing a number of new cells and then become dormant. This marks the end of the active or growing period and the beginning of the rest or dormant period. The thickening of the cell walls of the newly produced cells and their differentiation into permanent forms to which they are destined, like sieve tubes and latex vessels, now take place. Cells which are cut off towards the outside form tissues of the bark and those cut off towards the inside form tissues of the wood. When this is completed and the newly formed tissues have assumed their respective functions the dormant period ends and cell division in the *cambium* recommences. These alternate periods of cell division and tissue formation which are usually called growth periods and dormant (rest) periods respectively continue throughout the life of the tree. The periodical generation of additional tissues of the bark and wood, in this manner, by the *cambium*, causes increase in the girth of the tree. Growth in thickness of the bark and renewal of tapped bark are also the results of such *cambial* activity.

The stage of growth and dormancy of the *cambium* (secondary *meristem*) of bark synchronises with that of the primary *meristem* present at the growing points, for example the shoot bud, with which the former maintains a close living connection. It is, therefore, possible to determine the condition of the *cambium* in the bark of the tree by examining the condition of the shoot bud. When the primary *cambium* becomes active the shoot bud begins to grow and develop a new whorl of leaves. After a few days the shoot ceases to grow but the young leaves continue to expand until they attain their normal sizes. At this stage the growth period has completely ended and the shoot bud is dormant. The new leaves are very tender, brownish and hanging down vertically. The differentiation and development of tissues of the shoot and leaves or what is called the 'maturing' of the new shoot and leaves, now commences vigorously. When the new leaves have raised themselves to their normal, more or less horizontal, position on the shoot, and have become green and hard, the dormant period of the *meristem* or bud ends. Soon after, the *meristem* in the bud again becomes active, repeats the process of cell division and produces another flush of growth. This is again followed by a period of dormancy or rest. Hence, as cell division by the primary *meristem*

is responsible for the growth of the shoot bud, and as both the primary *meristem* and the secondary *meristem* called *cambium* become active or dormant simultaneously, the condition of the shoot bud indicates the condition of the *cambium* also. When the bud is growing the *cambial* cells will be active, that is, undergoing cell division. When the bud is dormant the *cambial* cells also will be dormant. In young seedlings and possibly young buddings also, there may be as many as 9 or 10 alternate periods of growth and dormancy in a year, represented by a similar number of whorls of leaves. The number of whorls present on a young seedling thus helps to estimate the approximate age of it.

This phenomenon in rubber plants have been applied for determining the suitable time for budgrafting rubber. It is well known that the bark of both the budwood and the stock-plant 'strips' easily when the *cambium* is active, i. e., undergoing cell division. Further the stock-plant 'takes' the bud and the operation will be more successful if budgrafting is done when the *cambium* is active. The correct stage for budgrafting may, therefore, be determined by examining the shoot bud.

The vital functions of the *cambium* tissue in the life of the tree are evident from what has been described above. Growth in girth and bark thickness, regeneration of tissues, renewal of tapped bark, in short the healthy development of the bark, and the whole tree itself depends on the health and proper functioning of the *cambium*. It is, therefore, necessary that great care should be exercised to see that no injury is done to the *cambium* during tapping operations. To cause the so-called "wounding" of the bark it is not necessary to tap the bark right down to the wood as is believed by some. Mere exposure of the delicate *cambium* tissue may be sufficient to cause wounds. Serious wounds made during tapping take a very long time to heal and may produce knobs on the tapped panel. A number of such wounds would, therefore, render the renewed bark uneven and difficult to be tapped again. In normal tapping, therefore, a thin wall of soft bark bordering the *cambium* is left untapped to protect this vital tissue.

The Latex Vessels

All the tissues described above are present in the same form or in modified forms in the bark of almost all woody plants. Latex producing species of plants form only a small proportion of the vast plant kingdom. The mode of occurrence of the latex producing tissue as well as the properties of latex vary in different species. The species *Hevea brasiliensis*, popularly known as the rubber tree, has been found to be the most important latex (rubber) producing species commercially. In the rubber tree, as in many other species, latex occurs in special tissues in the roots, trunk, branches, leaves, flowers and fruits. As we obtain rubber latex commercially from the bark of the trunk, only the structure of the latex producing tissue in the bark of the trunk is described here.

Latex in the bark of the rubber tree occurs in a tubular system called latex vessels. These tubular vessels are formed by the longitudinal fusion of long vertical rows of cells and by subsequent dissolution of their partition walls at the points of fusion. They have a thin lining of living protoplasm inside the wall and so are living elements.

In cross sections of the bark, Fig. 1, the cut ends of the latex vessels look like separate round cells arranged in rows. In the complete bark of the cylindrical trunk of the tree, these rows of vessels form distinct concentric rings or cylinders. The rings are separated by zones containing sieve tubes and the soft walled *parenchymatous cells*. In radial longitudinal sections, Figs. 1 and 2, the latex vessels appear like a series of straight lines parallel to the line of the wood surface. The vessels in the soft bark are continuous but those situated in the older portions of the hard bark are invariably broken up and disorganised as a result of the formation of stone cells. When the structure of the latex vessel system is viewed from another angle the tangential section, in Fig. 1 it looks like a net-work which may be compared to 'expanded metal' with narrow, elongated, diamond shaped meshes. Each row or ring of latex vessels may, therefore, be compared to a cylinder made of such expanded metal. A number of these cylinders of different diameters arranged one inside the other in series would present a similar picture as that of the latex vessel cylinders in the bark of the rubber tree. The round cells embedded in the meshes of the network are the cut ends of the *medullary ray* cells. Owing to their close proximity food materials may diffuse from the *medullary rays* directly into the latex vessels.

When the latex vessels within a cylinder come into contact with one another in the lateral direction to form the above 'expanded metal' type of structure, the cell walls at some points along the line of contact dissolve and produce small passages which make possible the movement of latex from one vessel into another. There is no such organic connection between one cylinder of vessels and another. Therefore, latex from the vessels of one cylinder will not pass into the vessels of another cylinder. When a few latex vessels of one cylinder are cut open as in tapping, latex from unopened vessels in that cylinder also might pass into the opened vessels through the passage between them and flow out. But, as there is no organic connection between the different latex cylinders, latex from vessels of cylinders seated deeper unless they are also cut open will not be drawn out. In other words, each cylinder will have to be tapped to obtain any latex from that cylinder.

In a population of seedling trees of mixed origin the number and distribution of latex vessel cylinders in the bark will be found to vary considerably from tree to tree. Some of these variations in the bark of about 6 years old seedling trees are illustrated in Fig. 3. In the bark of tree A, there is a large number of latex vessel rows arranged closely at more or less regular intervals. In B, there are fewer rows situated at wider intervals. They occur in groups of two or more in the bark of trees C and D, those in the latter being fewer and situated wider apart

and also farther out from the *cambium* as in B. In a population of budded trees of a clone, however, such wide variations in bark characters do not generally occur. The number and arrangement of latex vessel cylinders in the bark are more uniform and similar to those in the bark of the mother tree from which they have been budded.

The general direction of the latex vessels in the bark of the stem of the rubber tree is not quite vertically up and down the tree but in a spiral direction at a slight angle from the vertical to the right, when facing the tree. This is indicated in the tangential view of the latex vessels in Fig. 1. Therefore, if tapping cuts are opened in the normal left to right direction (when facing, the top end of the cut is on the left and low end on the right) a larger number of latex vessels, per unit length of the cut, will be opened up than when the cut is opened in the right to left direction.

DISCUSSION

Structure of the bark and commercial extraction of latex by tapping

The rubber tree is cultivated commercially for the crop of rubber latex it produces. The tree produces latex in special tissues situated largely in the soft bark as already described. To obtain latex the vessels which contain it have to be opened up. This is accomplished by what is called tapping, which consists of the excision of a thin shaving of bark. This operation, therefore, causes damage to some important tissues of the bark and interference with their functions which are essential for the normal growth of the tree. A proportion of the valuable food of the tree in solution called cell sap is also lost along with the latex. The severity of the damage done to the tree depends on the intensity of tapping. After long experimentation a system of tapping called the half spiral alternate-daily system (s/2, d/2, 100%) has been evolved which if applied carefully and skilfully would generally produce maximum yields consistent with the health and longevity of the tree. There are, however, exceptions as in the case of certain clones and seedling families where this system has been found to be rather intense and less intensive systems like the third daily system of tapping (s/2, d/3, 67%) are applied.

In the normal alternate-daily system, tapping cuts are opened in a left to right direction extending over half the circumference of the tree at an angle of 25 deg. to 30 deg. from the horizontal. Tapping is done on alternate days. Immediately after tapping, latex begins to exude from the open ends of the latex vessels and flows down the sloping cut but ceases after about three hours. As the flow slows down, latex on the surface of the cut coagulates forming a film which seals the open ends of the latex vessels and other tissues. The vessels from which latex had exuded now begin to absorb watery solutions of various substances from the surrounding tissues and to manufacture latex. The actual process of manufacture and the raw materials utilised in the process are not yet known. The vessels which are partially emptied as

a result of tapping, usually become full and turgid after the following day when the tree is ready for tapping again. It is on the basis of this theory that the alternate daily system of tapping is considered to be of 100 per cent intensity.

Depth of tapping

The depth of tapping and the rate of bark consumption vary in different rubber producing countries. These factors exert considerable influence on production of latex. In the chief rubber producing countries, Malaya and Indonesia, the depth of tapping is so regulated that a minimum margin of one millimeter of soft bark, outside the *cambial* zone, is left untapped. In actual practice this may vary between 1 and 1½ millimeters. This is considered to be a safe margin for protecting the delicate *cambium* tissue. When tapped to this depth a number of latex vessel cylinders, as already described, may be left unopened and yield is obtained only from the latex vessels situated in a narrow zone of the soft bark. For example, the case of the bark of the four trees illustrated in Fig. 2 may be considered.

There is a total of 24 rows (cylinders) of latex vessels in the soft bark of tree A. Of this, only 16 rows are tapped when tapping is carried to a depth of one millimeter outside the *cambium*. Eight, or one-third of the total number of latex vessel rows, therefore, are not tapped and so do not contribute to the yield of latex. Similarly in the bark of tree C, seven out of the total of 20 rows of latex vessels which are situated within one millimeter of the *cambium* are not affected by normal tapping and do not yield latex. From the point of view of latex crop, therefore, there is very little advantage in having a large number of latex vessels if a considerable proportion of them are situated close to the cambium, i. e., in the normally untapped zone of the bark. In the bark of trees B and D on the other hand, the arrangements of latex vessel rows are such that 10 out of 13 rows and 13 out of 15 rows respectively, lie outside the one millimeter zone and therefore are cut open during tapping. Only three rows and two rows respectively lie in the untapped zone and do not yield latex. From the above point of view, therefore, the distribution of latex vessel rows in the bark of B and D is more desirable.

Tapping deeper than the above limit of one millimeter of bark will of course produce more latex but this will damage the vital tissue *cambium*, produce knobs or protuberances on the renewing bark and delay bark renewal. Further, the yield of dry rubber will not be proportional to the quantity of latex obtained because it has been found that latex obtained by deep tapping has a lower dry rubber content than that obtained from shallow tapping. In other words, the latex in the newly formed vessels occurring near the *cambial* zone, contain less rubber or is more dilute than that in the more 'mature' vessels situated farther out towards the hard bark. Regular extraction of latex from the newly formed latex vessels may result in the development of the physiological disease called 'Brown-bast'. High rate of incidence

of this disease in a clone or seedling family indicates that the tapping system adopted is more intense than what that clone or family can tolerate.

Bark Consumption

It has been described above that as the flow of latex, after tapping, begins to slow down a film of coagulated latex is formed on the surface of the tapping cut which seals the open ends of the latex vessels. With the resting of the tree on the following day in the alternate-daily system of tapping, the cut ends of the latex vessels become blocked with a plug of coagulated latex. Therefore, the vessels will not be opened by the mere removal of the film which is called scrap. It will be found that the ends of the latex vessels are still blocked with the plug. To reopen the latex vessels, therefore, a thickness of bark sufficient to remove the plug of coagulated latex has to be shaved off by tapping. The rate at which the bark is shaved off is called the rate of bark consumption. It has been proved by experiments that by tapping of a larger thickness of bark than what is required to remove the plug, greater yields may not be obtained. Besides this, the regulation of the rate of bark consumption is also governed by the necessity of allowing sufficient time for satisfactory renewal of the tapped panel in order to make it available for tapping again after the panels on both sides of the tree have reached ground level. In Malaya and Indonesia the standard of bark consumption is 3/4 inch per month or in other words a thickness of bark equivalent to 1/20 of an inch is shaved off every alternate day. This is considered to be sufficient to remove the plugs and open all the latex vessels. Further at this rate of bark consumption and when tapping cuts are opened at 40 inches above ground level, there is nine years of bark renewal which period has been found to be sufficient in those countries for the renewed bark to be tapped again.

To obtain the maximum yield it is very important that an even thickness of bark should be shaved off along the whole length of the tapping cut. A skilled tapper can do this. If the thickness of the shaving of the bark is varied at places on the tapping cut as is usually done by unskilled tappers, although the average thickness may be the same as that of the skilled tapper, there will be parts where it is too thin to remove the whole plug of coagulated latex which blocks the end of the latex vessels. In this case maximum yields will not be obtained.

Depth of tapping and bark consumption in South Indian estates

In S. Indian rubber estates generally the standard of tapping is more conservative in regard to both the depth of tapping and bark consumption compared to the standard of those in Malaya and Indonesia. In some estates where great care is being exercised against causing wounds, a margin of more than 2 to 2½ millimeters of bark, compared to the standard of 1–1½ millimeters in the above countries, is found to be left untapped. The effect of this in lowering the yield should be con-

siderable. If the four trees the structure of bark of which is illustrated in Fig. 2 are tapped only to a depth of say 2 millimeters from the *cambium* the result would be as follows :—

Tree	Number of latex vessel rows in soft bark		
	Total	Within 2 mm. of the cambium untapped	Outside 2 mm. zone : tapped
A	24	16	8
B	13	7	6
C	20	13	7
D	15	5	10

The number of latex vessel rows tapped would, therefore, as may be seen from the above table, be much less. The yield from a particular tree will, in a large measure, be proportional to the number of latex vessel rings tapped. One of the factors for the low standard of yield obtained in India, therefore, seems to be the conservative shallow tapping. The reasons attributed for the adoption of shallow tapping in India are :—

1. Bark renewal under S. Indian soil and climatic conditions is poorer than in other countries ; by leaving a larger thickness of bark untapped, better renewal may be obtained.
2. Heat and dry conditions during some months of the year may affect the cambium if a thicker wall of bark is not left untapped to protect it.

Sufficient experimental data in support of the above are, however, lacking.

As regards bark consumption the standard rate in S. Indian estates is half inch per month, that is, the shaving off of 1/30 of an inch thickness of bark at each tapping. The tapping knife used in India and Ceylon is the " Michie Golledge " pattern which is specially designed to allow a minimum of bark consumption compared with the different patterns of knives used in other countries. Even with this specially designed knife, to regulate bark consumption at this rate would require, on the part of the tapper, greater skill than his counterpart in Malaya or Indonesia, and still greater skill to shave off an even thickness of bark at the same rate along the whole length of the cut. Consequently, the chances are greater that all the latex vessels may not be opened by the average tapper and therefore the maximum yield not obtained.

The total annual bark consumption at the rate of half inch per month amounts to 6 inches. But the rubber trees are rested for 1-1½ months during wintering. Monsoon rains make tapping impossible on many days during that season. If allowance is made for all this the bark consumption may not exceed about 5 to 5½ inches a year. To complete tapping of two, 40 inches, half circumference, panels on the

two sides of the tree at this low rate would require 14 to 16 years. It is a fact that the rate of growth of rubber trees under conditions obtaining in most of the planting districts in S. India is slower than that in Malaya or Indonesia and that the trees become tappable only in the 8th year instead of in the sixth year in the above countries. As it has been found that there is a close relation between the rate of growth (in girth) of the trees and the rate of its bark renewal, the latter should be presumed to be slow to the same extent as the growth of the trees. On this analogy, therefore, the renewed bark should be tappable at the end of the eleventh year instead of at the end of the ninth year in the above countries. In the circumstances the question naturally arises whether it is necessary to allow the tapped panel to renew for such a long period as 14 to 16 years and thereby risk the chances of not obtaining maximum yield by strict adherence to the low rate of bark consumption being practised in this country. It is difficult, however, to answer this question as well as the question of the depth of tapping without sufficient experimental data.

It is important that the health and longevity of the tree should receive first consideration. But it is equally important that the crop obtained should prove to be economical. The two interests are, therefore, conflicting. If the former is stressed too much the latter will suffer and if the latter is stressed too much the former will suffer. Therefore, until it is definitely proved by actual experiments that deeper tapping and a higher rate of bark consumption than what is now being practised in most estates will produce better returns without unduly straining the tree, it is of course advisable to follow the safer course and adhere to the present practice. However, in areas where there is fairly dense shade from the canopy of leaves above and a satisfactory plant cover on the ground, dry conditions in the same degree as is feared may not prevail and slightly deeper tapping than what is now practised in many estates, say up to $1\frac{1}{2}$ millimeters from the *cambium* is worth a trial. Sun-scorch under these conditions is likely only after defoliation during the wintering but trees are not generally tapped during this period. In old areas particularly where it is planned to replant within the next about 10 years, the next renewed bark will not be tapped and therefore deeper tapping even if it causes occasional wounds could be undertaken to obtain increased crop for some years prior to the application of slaughter tapping.

While the standard of tapping on large rubber estates is rather on the conservative side it is frequently carried to the opposite extreme particularly in the smaller units of small holdings. Conditions in these latter are deplorable. Instead of the normal alternate daily tapping practised in estates, daily tapping of double the intensity is the general practice in small holdings. This alone involves double the bark consumption. Tappers employed are invariably unskilled and there is no proper supervision. Left to himself the unskilled tapper who may have found out by experience that 'deeper the tapping greater is the crop of latex' applies it to extract the maximum possible crop. As a result of

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this, large wounds are caused which not only delay bark renewal but also develop knobs (protuberances) on the tapped panel. In extreme cases patches of exposed wood also may be noticed. Owing to the high rate of bark consumption which is more than double that of normal alternate daily tapping all the virgin bark of young trees become exhausted in 5 or 6 years. This necessitates resumption of tapping of the renewing bark within that period and it is well known that at that stage it will not be ready for tapping again. This fact is disregarded and tapping is carried on as usual without any rest for the trees. Yield will naturally be poor and uneconomic and the second renewal worse than the first and the renewing bark practically untappable. All these affect the health and longevity of the tree. The main cause of the poor growth of rubber trees and their poor foliage in small holdings is more on account of the direct and indirect results of careless, intensive tapping than to any other single factor.

That the healthy good bark of the rubber tree is the most valuable asset of the rubber grower is not fully realised by the average small holder. Neither does he realise that careless and drastic tapping would, in the long run, seriously affect the bark renewal and growth of the tree and that his income would dwindle down to uneconomic levels, on account of this. In his ignorance he neglects the health of the tree to obtain the maximum crop with disastrous results in the long run, somewhat like the parable of 'the man who killed the goose that laid the golden eggs.' Conditions in leased rubber holdings and also where tapping is done on a half and half crop (for owner and tapper) basis are no better because the lessee or the tapper respectively are concerned more about his profit than about what happens to the tree in the long run.

For the proper undertaking of the delicate and skilled operation of tapping the bark of the rubber tree to obtain maximum crop consistent with the health and longevity of the tree, it is essential that those engaged in it should possess a fair knowledge of the general structure of the bark. It would be ideal if the staff on estates who supervise tapping could explain to the tappers, in his own language, with suitable demonstrations, the general outline of the structure of the bark he taps. This should of course help to increase the standard of his efficiency.

'te genera

Function of latex in the life of the rubber tree

It is remarkable that though we know so much about the latex producing tissue, the properties of latex and how to utilise latex and raw rubber in the progress of civilisation, we know very little about the functions of this versatile product in the life of the rubber tree. Opinion among rubber scientists vary. Some of them believe that it is a waste product of the tree and that it does not serve any useful purpose in the life of the tree while others hold the contrary view. Neither views have been substantiated satisfactorily.

THE ROLE OF MANURES AND FERTILIZERS IN AGRICULTURE *

By

I. CHATTERJEE.

There is a widespread controversy on the propriety of using artificial or chemical fertilizers. In fact sometimes there has been virulent and unprovoked attack, as Ogg calls it (1947), on the practice of using these fertilizers. It is, therefore, necessary to consider the matter with due regard to the factual evidence.

Conventional terms

At the outset we have to make a clear distinction between what is understood by the conventional terms, manures and fertilizers. Manures are supposed to be those materials which are obtained from so-called natural sources such as cattle dung, compost etc. Their main characteristic is that they contain a large quantity of organic matter. On the other hand fertilizers are concentrated forms of important plant nutrients produced mainly by artificial means and generally containing little organic matter. Some materials are on the border line and it is difficult to classify them. Manures thus largely contain humus and other organic matter in which the mineral nutrients remain intermixed. In other words organic manures also include mineral nutrients.

As a matter of fact there is a gradual decomposition of organic matter everywhere and more quickly in tropical soils leading to mineralisation through the breaking up of end products into simple mineral components on one side, and water, carbon dioxide, some forms of nitrogen, ammonia, etc. on the other.

Nitrogen, Phosphorous and Potash

A plentiful supply of nitrogen to a plant would mean rapid growth with an extensive leaf area and size of stem. A deficiency of nitrogen would lead to stuntedness and slow rate of growth. Generally the leaves are dark green when copious supply of nitrogen is available but yellowish green and even yellow when nitrogen supply is inadequate.

Phosphoric acid stimulates seedling development and the formation of a good root system ; later on, in the life of a plant, it encourages early ripening. Potash stimulates the formation of carbohydrates. It is connected with the health and vigour of plants, for, a good supply of potash has frequently been observed to enable a plant to withstand attack of pests or other adverse factors. It has been ound in the case of jute that potash checks stem-rot. A manure containing nitrogen, potassium and calcium proved very profitable giving an yield of 20 maunds of fibre as against 8·2 maunds with farmyard manure alone. The percentage of stem-rot was 18·7 as against 38·5 in the plot with farmyard manure.

* Reproduced, by kind permission, from "Indian Farming", Vol. No. 11, July 1950.

The balance of food needs will, however, vary considerably from one type of plant to another.

Dispassionate appraisal

All soils do not possess these nutrients in adequate amounts to meet the demands of continuous and/or intensive cropping. The need thus arises of supplying them by other means necessarily falling outside the so-called natural sources. This is how the much maligned word 'artificial' comes into the picture. Rightly or wrongly the use of fertilizers all over the world is proceeding apace and despite opposition it is obtaining a stronger foothold. What is, therefore, needed is a dispassionate appraisal of efficiency of both manures and fertilizers in the field of agriculture.

Two schools of thought

There are two schools of thought, one led by Howard and the other by a large number of soil scientists and agronomists. In his book, *Agricultural Testament*, Howard denounced chemicals and fertilizers. A large number of disciples have gathered round him, and such books as Balfour's *The Living Soil*, Syke's *Humus and the Farmers*, Rodale's *Pay Dirt*, King's *Gardening with Compost* and Drummand's *Charter for the Soil*, etc. are the outcome.

The natural organic matter as obtained from farmyard manure, compost and so forth, say the protagonists of organic manure is all that is needed to maintain soil fertility, and artificial fertilizers are to be shunned as injurious. There is, however, a confusion in classifying the inorganic fertilizers. For instance Rodale states (vide Pay Dirt. 6) that 'for the purposes of this book the terms chemical fertilizer or chemical shall be taken to mean those commercial or synthetic substances extensively used in the last fifty years in crop production which in combination with elements in the soil tend to produce insoluble salt residues that are detrimental to fertility.' According to him ground limestone, delomite and other forms of natural lime, and the ground phosphate rocks, which are chemicals, strictly speaking, are not to be considered 'chemical fertilizers' for the purpose of his book. However, the main points stressed by this school of thought may be set forth as follows:—

1. Nature is the supreme farmer. We should, therefore, leave the problem of maintenance of fertility to Nature, by simply ensuring the return to the soil of organic wastes.

2. Plants raised with chemical fertilizers are much more liable to pests and diseases. Plant diseases will cure themselves when plants are raised on humus manure.

3. The nutritional values of crops raised with compost are higher than those of crops given fertilizers.

4. Conjoint animal-vegetable type of humus is the type we must provide.

Their further contention is that—

Certain fungoid reactions are of fundamental importance to plant nutrition. Chemicals inhibit the growth and development of these fungi as well as of soil micro-organisms and earth-worms.

If Nature is the supreme farmer and if artificials are to be shunned, does it not logically follow that we should strictly depend on Nature as we did in primitive days? Yet agriculture has gone forward step by step only by artificial means. Man has produced varieties of flora and fauna artificially to suit his special needs. Judged against this background not only has agriculture discarded from its very dawn the simple path of Nature but has followed a course which from the view-point of the dissentient school should be called essentially and fundamentally unnatural. Agriculture involves soil treatment which Nature never undertook before.

As regards the contention that plants raised on chemical fertilizers are more liable to pests and diseases, this is not borne out by facts. In India at any rate the use of artificials is negligible. Yet in 1946-47 a large part of wheat area covering Madhya Bharat, Bombay, Madhya Pradesh, etc., was devastated by rust. In 1845 potato blight devastated Poland, Germany, Belgium, France and England. This occurred when fertilizers were not used. The interesting point here is that the very chemicals and artificials which are so vehemently condemned, actually come to the rescue in another form. The discovery of Bordeaux mixture led to the control of the disease.

Nutritional values.

As regards the claim that 'the nutritional value of compost raised crops is higher than that of chemically raised crops' this is not substantiated by facts. Ogg, Director, Rothamstead Experimental Station, remarks that tests carried out some years ago at the Dunn Nutritional Laboratories in Cambridge, showed that the vitamin B_1 potency of wheat grown at Rothamstead on plots which had received heavy annual dressings of fertilizers for over ninety years was at least equal to that from the plot which had received fourteen tons of farmyard manure annually over the same period. A similar result was obtained from barley from the classical Hoos field, and potatoes grown in a normal rotation, when tested for vitamin C, showed no difference whether grown with dung or sulphate of ammonia.

Recently Arnon, Simms and Morgan* studied the effect of soil organic matter or humus on the nutritional value of plants by feeding to guinea pigs grass grown in a fertile soil, and in a large scale artificial water culture medium free from humus. The animals in both groups showed good growth and gave evidence of nutritional well-being. No evidence was found that plants grown in an inorganic medium are deficient in any dietary essentials. As a matter of fact organic matter has no significant function in determining the dietetic quality of plant products as it has been established from various experiments that green plants are

* Soil Science (1947), 63, 129—134.

capable of synthesizing all their organic constituents, provided they are supplied with inorganic nutrients and are grown under favourable environmental conditions. In their recent analysis of manurial data on rice for the whole of India Ramiah and Sahasrabuddhe § state that 'there is no critical experimental evidence to show that repeated application of the fertilizer (ammonium sulphate) without organic matter does harm to the soil.'

Effect of micro-organisms

As regards the next point that we must provide conjoint animal-vegetable type of humus, no one will question its value but its limited availability precludes the possibility of its extensive application.

On the contention that chemicals inhibit the growth of soil micro-organisms, Ogg states that careful tests, made on the classical plots at Rothamstead, have given evidence that the application of inorganic fertilizers, even for many successive years, did not have any deleterious effect on the population of soil micro-organism.

It should be stated here that a mere increase in the number of micro-organisms is not necessarily beneficial to the crop. Indeed, if there is too much organic matter, rich in carbohydrates, the increase in micro-organisms may make so heavy a demand on plant nutrients as to compete with, and even temporarily to starve the crop. At the same time there is no doubt that microbial activity resulting from the presence of organic matter is largely responsible for improvement of soil structure.

Danger of soil erosion

Soil erosion is another danger associated, it is alleged, with the use of artificials. It has been stressed that widespread use of artificials in India is fraught with the possibility of huge areas, should fertility decline, being reduced to a 'dust bowl' that would make the U. S. disaster pale into insignificance. It should, however, be stated here that in the 'dust-bowl' of America the average annual consumption of fertilizers just before the war was less than 2 lbs. per acre of crop. Dr. Crowther has recently pointed out that the average consumption of fertilizers in Kansas, Colerado, and Oklahama, three of the States worst affected by soil erosion, was about 1 cwt. of sulphate of ammonia, 15 cwts. of superphosphate, and less than 1 cwt. of muriate of potash per 1000 acres. It will thus be seen that the incriminating substances were far too small in amount to be responsible for such an enormous damage. "As a matter of fact," as Dr. Crowther observes, "the dust-bowl was caused by too frequent ploughing and not by too much fertilizers. The remedy will be found in more cover crops and leys and to establish these much more fertilizers will be needed." It may also be stated here that while erosion has been due to neglecting the humus factor in soil maintenance, it cannot be said to result from the

§ Stewart (1927) *Report on Soil Fertility Investigations*, Indian Council of Agricultural Research, p. 149.

practice of using fertilizers. Unfortunately to the anti-fertilizer school this fact, i. e., the neglect of humus factor, is considered to be a potent argument to justify an attack on the use of fertilizers with the effect that in the long run the interest of agriculture really suffers. If crops, which are not soil protective, are grown repeatedly and the soil is mercilessly exposed to the operation of various erosive factors, the fault certainly does not lie with fertilizers, nor can the fertilizers be condemned if they are misused. In fact the remedy in such cases of bad farming lies in giving the land proper rest, in initiating balanced rotation, and in introducing suitable agronomic practices. It is well known that on account of large scale deforestation, defective water control, injudicious cultivation of slopes, overgrazing and other mal-practices, erosion of land has increased to an alarming extent in many parts of India. Yet India is a country where artificials have so far been the least used; and if the non-application of artificials is any criterion of better production, we would not have been faced with notoriously poor yields in India. This state of affairs is due to the fact that in the large majority of soils, the nitrogen status is very low, and in others, phosphate, calcium or / and potash are deficient. If India's production has to be stepped up, these soil deficiencies have to be rectified. Can this be done exclusively by the use of organics or can this be better done by balanced and judicious application of both organics and inorganics in due proportion to the respective requirements of both? The main point, therefore, is that neither the virtues of one be over-estimated nor the vices of the other be over-emphasized. Each has to be judged in its proper perspective. For instance, although organics have no doubt many virtues, there are definitely some which are refractory in the sense that they resist decomposition. These are, hair, hide scraping, hoof and horn meal, wool waste, feathers, shoddy and felt, scrap fur, silk waste, etc. Such materials have to be suitably treated by mixing them with phosphatic rock and treating the mixture with sulphuric acid in much the same way as super phosphate is made. By this means the nitrogen content is converted partly into ammonium sulphate and partly into organic compounds that are readily available for plant intake. This is how inert materials can be converted from either sources, organic or inorganic, into forms furnishing valuable plant food; yet obviously the method is nothing but chemical and artificial. In using manurial resources what we have to guard against is that there may not be any misuse or wrong use whether it is of an organic manure or an artificial fertilizer.

Different requirements.

There is no doubt that certain constituents of organic manure are of value in promoting plant growth substances and creating B-indol lactic acid Skatol, etc. But nowadays these requirements can be more efficiently and quickly met through the synthetic plant hormones which again are artificially produced. The soluble organic matter probably also aids in keeping iron and phosphorus in solution, thus making them available to the plant. For this reason it is obviously

of value to ensure a reasonable supply of organic matter to the soil. But different requirements have to be properly adjusted. For instance, it has been definitely established that success in green manuring depends to a great extent on the availability of moisture. The latter seems to be equally important in the case of farmyard manure which in some experiments as at Jalgaon (under wheat), gave a negative result due to the depletion by it of the limited moisture supply in the soil.

The experiments at Indore on wheat have shown that at the high level of nitrogen applied, nitrogen from an organic source (compost, night soil, farmyard manure) was more effective than from ammonium sulphate. On the other hand the Madhya Pradesh experiments show that the combination of organic and inorganic nitrogen is more effective than either applied singly. In Sakrand in Sind compost was of little value as a source of nitrogen ; on the other hand, the response to ammonium sulphate was as much as 15 to 30 lbs. per lb. of nitrogen applied as compared to only 0·7 lb. per lb. of nitrogen applied as compost. A remarkable result with jowar was observed at Dharwar when the response to oil-cake was increased to threefold or more when applied on a basal dressing of farmyard manure. These results from different places and crops show that both organic and inorganic manures are equally important and so far as the former is concerned, as so aptly put by Ogg, 'every scientific agriculturist realizes the value of organic manures and advocates their careful conservation and fullest possible use.' At the same time it is of greatest importance, as has been pointed out by Stewart, neither to overstate the case of organic manures nor to minimise the value of mineral supplements. The general evidence available at present shows that both have their uses, and that they should be regarded as complementary in their effects. Dr. Stewart has also stated that it is sound policy to take every reasonable step to insure the return to the land of all organic waste materials with mineral and other fertilizers which can bring about improvement of soil fertility. Judged by these facts there is hardly any justification for deprecating the use of fertilizers. This attitude originates from prejudice based more on belief than on observed facts. Here a simple fact may be mentioned. Fertilizers can be profitably used in producing humus as, for instance, by phosphate manuring of leguminous crops for the production of green manure. It is also overlooked that when a nitrogenous component is added to the soil through oil-cake, farmyard manure or ammonium sulphate, it is ultimately transformed to some assimilable form before it could possibly be utilised by the plant. For instance in a large majority of cases nitrogen is assimilated in the form of nitrate. There are various types of micro-organisms involved in this transformation and each is responsible for bringing about its particular reaction leading ultimately to nitrification or nitrate formation. Judged in this context an organic manure will necessarily take a longer time in attaining the assimilable level of nitrification.

This explains why the most widely used manure, as a source of nitrogen, viz., farmyard manure, is considerably slower in its action than equivalent amounts of nitrogen in readily available and concentrated form. On the other hand response to fertilizers in some soils may be enhanced if they are used to supplement basal dressings of bulky organic manures; it must be pointed out that response to the latter also depends on the degree of their decomposition, their moisture content and the initial nitrogen status of the soil.

The fact should also be taken into account that nitrogen deficiency is extremely widespread in India and can only be made good by such manures or fertilizers which are available in a concentrated form and the transport cost of which will be the least. Bulky organic manure cannot serve this purpose. What is, therefore, needed is that within the vicinity of an area where bulky organic manures are available or in cases in which transport charges justify this course such manures should be used. In other cases green manuring supplemented with some fertilizers like superphosphate will be suitable, perhaps more so from the point of view of economics. In still other cases ammonium sulphate has to be used. This is how a proper balance between soil fertility and crop production may be attained.

PRICE OF RAW RUBBER

Ministry of Commerce and Industry

NOTIFICATION

Rubber Control

New Delhi, the 21st May, 1951.

S. R. O. 759—In exercise of the powers conferred by subsection (1) of section 13 of the Rubber (Production and Marketing) Act, 1947 (XXIV of 1947), and in supersession of the notification of the Government of India in the Ministry of Commerce and Industry, No. S. R. O. 335, dated the 7th March 1951, the Central Government, after consulting the Rubber Price Advisory Committee, hereby fixes, *for a period of one year* with effect from the 21st May 1951 for all classes of business

the following maximum and minimum prices for the various grades and qualities of rubber mentioned below :—

Grade and quality of rubber		F. O. B. Cochin for 100 lbs. Maximum price			Minimum price		
		Rs.	*as.*	*p.*	*Rs.*	*as.*	*p.*
Group 1	R. M. A. IX	128	0	0	127	0	0
	R. M. A. 1	128	0	0	127	0	0
Group 2	R. M. A. 2	126	8	0	125	8	0
	R. M. A. 3	125	0	0	124	0	0
	Cuttings No. 1	117	8	0	116	8	0
Group 3	R. M. A. 4	121	8	0	120	8	0
	R. M. A. 5	117	8	0	116	8	0
	Cuttings No. 2	111	8	0	110	8	0
Group 4	Precoagulated Crepe	133	8	0	132	8	0
	Pale Latex Crepe IX	131	8	0	130	8	0
	Pale Latex Crepe 1	129	8	0	128	8	0
	Pale Latex Crepe 2	128	8	0	127	8	0
	Pale Latex Crepe 3 FAQ	127	8	0	126	8	0
Group 5	Estate Brown Crepe IX	119	8	0	118	8	0
	Estate Brown Crepe 2X	116	8	0	115	8	0
	Smoked Blanket	119	8	0	118	8	0
	Remilled Crepe 2	112	0	0	111	0	0
Group 6	Estate Brown Crepe 3X	108	8	0	107	8	0
	Remilled Crepe 3	106	8	0	105	8	0
	Remilled Crepe 4	101	0	0	100	0	0
Group 7	Flat Bark	92	8	0	91	8	0
35% Normal Latex (excluding cost of container)		129	0	0 *plus* a premium of Rs. 17-8-0 per 100 lbs. of D. R. C.	128	0	0 *plus* a premium of Rs. 17-8-0 per 100 lbs. of D. R. C.
50 to 55% concentrated preserved latex (excluding cost of container)		129	0	0 *plus* a premium of Rs. 43-0-0 per 100 lbs. of D. R. C.	128	0	0 *plus* a premium of Rs. 43-0-0 per 100 lbs. of D. R. C.

[No. 19(1)-R(Plant)/51]

S. A. VENKATARAMAN,
Secretary.

RAW RUBBER INDUSTRY

Summary of Indian Tariff Board's Recommendations and Government of India's decisions thereon

(NEW DELHI, AUG. 24).

The following are the recommendations of the Tariff Board on the claim of the raw rubber industry for protection and assistance. (The Government's decision is given in brackets after each recommendation):

(1) It is not improbable that the world price of rubber may continue to be higher than the estimated fair selling price for indigenous rubber for a few months more. For this period, therefore, the question of protecting indigenous rubber from the competition of foreign rubber by levying an import duty or by restricting imports of rubber, is not likely to arise. (Accepted).

(2) It would be in the interest of the indigenous rubber growers in the long run to continue the present system of protection and assistance, viz., the fixation of a schedule of statutory prices and making such prices effective through import control if and when required. (Accepted).

(3) If and when owing to an appreciable fall in the price of rubber in the world market, indigenous rubber has to be protected, such protection should be given by means so far used. (The method of protection to be adopted will be considered when the occasion arises).

(4) If the Indian rubber plantation industry is to survive and compete in a free world market it is essential that rubber should be produced as cheaply as possible, as this can only be done by the introduction of new high-yielding clones. (The attention of the industry is invited to this recommendation).

(5) There is further scope for improvement in the quality of the indigenous rubber. The Indian rubber plantation industry should, therefore, take steps to make such improvements. (The attention of the industry is invited to this recommendation).

(6) The proposals contained in the development scheme drawn up by the Indian Rubber Board are well conceived. It is desirable, however, that the details of the scheme should be fully examined. The Indian Council of Agricultural Research should be requested to examine the scheme and report to the Government whether any modifications are necessary. (Accepted).

(7) The I. C. A. R. should also consider the proposal for the creation of a separate development fund. Meanwhile, the rubber producers should be allowed to retain the element (Rs. 6 82 per hundred lbs.) provided for rehabilitation in the present price of rubber. (Accepted. The Indian Rubber Board will be requested to examine the suggestion).

(8) If it is found at the end of the year that the rubber growers are not utilising the amount for rehabilitation of their estates and holdings, the Government should consider the question whether the fair selling price to be paid to the rubber growers should not be reduced by the amount of the rehabilitation fund element. (Accepted. The attention of the industry is invited to this recommendation).

(9) An All-India rubber research institution should be established which should work in close co-operation with the Indian Rubber Board and under the guidance and supervision of the Rubber Production Commissioner. (Accepted).

(10) The Government should request the I. C. A. R. to examine the scheme for research, and if it is found suitable, steps should be taken to

the following maximum and minimum prices for the various grades and qualities of rubber mentioned below:—

Grade and quality of rubber		F. O. B. Cochin for 100 lbs. Maximum price			Minimum price		
		Rs.	*as.*	*p.*	*Rs.*	*as.*	*p.*
Group 1	R. M. A. IX	128	0	0	127	0	0
	R. M. A. 1	128	0	0	127	0	0
Group 2	R. M. A. 2	126	8	0	125	8	0
	R. M. A. 3	125	0	0	124	0	0
	Cuttings No. 1	117	8	0	116	8	0
Group 3	R. M. A. 4	121	8	0	120	8	0
	R. M. A. 5	117	8	0	116	8	0
	Cuttings No. 2	111	8	0	110	8	0
Group 4	Precoagulated Crepe	133	8	0	132	8	0
	Pale Latex Crepe IX	131	8	0	130	8	0
	Pale Latex Crepe 1	129	8	0	128	8	0
	Pale Latex Crepe 2	128	8	0	127	8	0
	Pale Latex Crepe 3 FAQ	127	8	0	126	8	0
Group 5	Estate Brown Crepe IX	119	8	0	118	8	0
	Estate Brown Crepe 2X	116	8	0	115	8	0
	Smoked Blanket	119	8	0	118	8	0
	Remilled Crepe 2	112	0	0	111	0	0
Group 6	Estate Brown Crepe 3X	108	8	0	107	8	0
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	Remilled Crepe 4	101	0	0	100	0	0
Group 7	Flat Bark	92	8	0	91	8	0
35% Normal Latex (excluding cost of container)		129	0	0 *plus* a premium of Rs. 17-8-0 per 100 lbs. of D. R. C.	128	0	0 *plus* a premium of Rs. 17-8-0 per 100 lbs. of D. R. C.
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(2) It would be in the interest of the indigenous rubber growers in the long run to continue the present system of protection and assistance, viz., the fixation of a schedule of statutory prices and making such prices effective through import control if and when required. (Accepted).

(3) If and when owing to an appreciable fall in the price of rubber in the world market, indigenous rubber has to be protected, such protection should be given by means so far used. (The method of protection to be adopted will be considered when the occasion arises).

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(6) The proposals contained in the development scheme drawn up by the Indian Rubber Board are well conceived. It is desirable, however, that the details of the scheme should be fully examined. The Indian Council of Agricultural Research should be requested to examine the scheme and report to the Government whether any modifications are necessary. (Accepted).

(7) The I. C. A. R. should also consider the proposal for the creation of a separate development fund. Meanwhile, the rubber producers should be allowed to retain the element (Rs. 6·82 per hundred lbs.) provided for rehabilitation in the present price of rubber. (Accepted. The Indian Rubber Board will be requested to examine the suggestion).

(8) If it is found at the end of the year that the rubber growers are not utilising the amount for rehabilitation of their estates and holdings, the Government should consider the question whether the fair selling price to be paid to the rubber growers should not be reduced by the amount of the rehabilitation fund element. (Accepted. The attention of the industry is invited to this recommendation).

(9) An All-India rubber research institution should be established which should work in close co-operation with the Indian Rubber Board and under the guidance and supervision of the Rubber Production Commissioner. (Accepted).

(10) The Government should request the I. C. A. R. to examine the scheme for research, and if it is found suitable, steps should be taken to

implement it with the co-operation of the Governments of Madras and Travancore-Cochin, the Indian Rubber Board and the I. C. A. R. (Accepted).

(11) The Rubber Board should examine the proposals for remedying the shortcomings in the marketing of rubber made by Mr. D. V. Reddy in his report on the marketing organisation for rubber and take suitable steps to improve the organisation. (Accepted).

Applications for Iron Pipes, Tubes and Fittings required by Rubber Estates

The Indian Rubber Board has been forwarding to the Iron and Steel Controller, Calcutta, applications for pipes, tubes and fittings from rubber estate owners as and when received, with necessary recommendations. The Iron & Steel Controller has desired that in future the Board should consolidate all demands into one statement and send it to his office within the due dates prescribed by him from time to time, with the Board's recommendations. The last date for receiving demands for period I/52 (January-March, 1952) is fixed as the 15th October 1951. The due date for period IV/51 (October-December, 1951) is already over. Rubber growers who require any iron pipes, tubes and fittings *for their estates* may send their applications in the prescribed form to the Indian Rubber Board. Copies of the prescribed application form will be supplied by the Board's office on request. The application should be supported by full details as to how their requirement has been arrived at. It may be noted that the due date fixed by the Iron & Steel Controller for receipt of demands for pipes, tubes and fittings is invariably about 10 weeks before the commencement of the quarter to which the demand relates. Applications should therefore reach this Board atleast 10 days before the due date fixed by the Iron & Steel Controller in order to enable the Board to consolidate the demands and make suitable recommendations.

RUBBER STATISTICS

Monthly production of raw rubber (tons) 1948-51

Months	1948	1949	1950	1951
January	1425	1326	1291	1307
February	270	257	208	260
March	956	798	988	902
April	1498	1563	1640	1664
May	1646	1240	1450	1808
June	694	854	836	562
July	844	904	758	
August	1068	1245	1053	
September	1646	1410	1414	
October	1796	1944	1937	
November	1742	2011	1975	
December	1837	2035	2049	
Total :—	15422	15587	15599	

Monthly consumption of raw rubber (indigenous and imported) by rubber goods manufacturers (tons) 1948-51.

Months	1948	1949	1950	1951
January	1587	1548	1162	1868
February	1494	1414	1295	1894
March	1587	1284	1320	1821
April	1608	1981	1435	2134
May	1432	1847	1372	1576
June	1875	1770	1517	1131
July	1801	1785	1800	
August	1902	1819	1670	
September	1753	1638	1506	
October	1109	1068	1253	
November	1700	1697	1737	
December	1811	1341	1668	
Total :—	19719	19192	17735	

World production of raw rubber (tons) 1948-1950.

Countries	1948	1949	1950
Malaya	698189	671503	694086
Indonesia	432349	431841	687479
Ceylon	95000	89500	113500
Vietnam and Cambodia	43935	43010	48482
India	15422	15587	15599
Sarawak	39680	39461	55615
Other Asia	127500	125000	150000
Africa	42000	45000	55000
Brazil	20158	21318	19915
Others	10452	6859	9809
Total :—	1524685	1489079	1849485

Imports of Raw Rubber during 1948-51 (Tons)

Months	1948	1949	1950	1951
January	...	501	339	945
February	...	354	41	1377
March	...	954	44	1124
April	...	691	...	850
May	...	9	132	521
June	315	71	44	477
July	705	...	...	
August	444		...	
September	941	3	...	
October	649	2	75	
November	595	66	175	
December	684	116	232	
Total	4333	2767	1082	

Production, Consumption and Stocks of Rubber January—June, 1951 (Tons)

Groups	Production (January-June 1951)	Consumption by manufacturers. (January-June 1951)	Stocks with estates and dealers as on 30-6-51.	Stocks in transit sold to manufacturers as on 30-6-51.	Stock with manufacturers as on 30-6-51.
Group 1	2353	3530	1043	604	819
Group 2	1253	3716	700	380	219
Group 3	512	593	432	194	70
Group 4	539	297	269	68	102
Group 5	308	1040	305	136	392
Group 6	195	389	184	44	67
Group 7	20	42	44	5	26
Scrap Grades	665	98	502	...	93
Latex (DRC)	427	275	305	3	190
Sole Crepe	231	104	169	...	36
Estimated unspecified		*340			*150
Total	6503	10424	3953	1434	2164

*Estimated consumption and stock with some manufacturers from whom returns have not been received.

Note :—The excess consumption of rubber over production has been met out of opening stocks for the year and imports.

Rubber Prices in Ceylon and India

GRADES	Average monthly F. O. B. Colombo prices for 100 lbs. (1951)						Controlled Indian Minimum F. O. B. Cochin price for 100 lbs.		
	January	February	March	April	May	June	From 28-5-1949	From 7-3-1951	From 21-5-1951
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
RMA 1	296·75	331·38	339·56	306·75	251·63	230·85	89·50	121·50	127·00
RMA 2	288·75	322·00	328·94	295·88	247·06	225·90	88·00	120·00	125·50
RMA 3	280·75	306·69	308·94	282·88	242·13	218·25	86·50	118·50	124·00
RMA 4	270·75	293·25	292·38	268·38	232·88	204·20	83·00	115·00	120·50
RMA 5	250·75	273·25	272·38	250·50	217·44	186·75	79·00	111·00	116·50
Pale Latex Cr. IX	320·19	341·94	352·19	342·75	300·06	265·40	93·00	125·00	130·50
„ 1	309·69	338·31	344·81	337·31	228·75	260·15	91·00	123·00	128·50
Flat Bark	206·56	215·00	218·38	208·75	174·44	148·05	54·00	86·00	91·50

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The Cement Marketing Co. of India Ltd.
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The Dunlop Rubber Co. (India) Ltd.,—A. D. V. Equipment.
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John Blake Ltd.,—Rams & Hydrams.
John Fleming & Co. Ltd.,—Guniting.
Joseph Robinson & Co. Ltd.,—Rubber Machinery.
Killick, Nixon & Co. Ltd.,—SNOWCEM and Coloured Cements.
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The Paterson Engineering Co. (India) Ltd.,—Water Filter Plants etc.
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The Whitecross Co. Ltd.,—Copper Wire.

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THE
INDIAN RUBBER BOARD
BULLETIN

Vol. I | JULY—SEPTEMBER 1951 | No. 3

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Official organ of the Rubber Growers' Association of India, Kottayam.

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A publication of the Rubber Growers' Association of India, to bring together the rubber producers in the country, for promoting a concerted effort to make their voice heard in the right place and time through a common medium.

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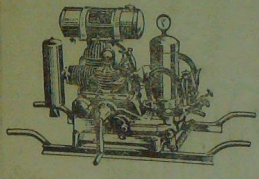

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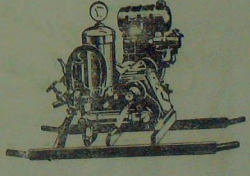

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THE
INDIAN RUBBER BOARD
BULLETIN

Vol. I | JULY—SEPTEMBER 1951 | No. 3

EXTRACTS FROM THE REPORT OF THE INDIAN TARIFF BOARD ON PRICES FOR RAW RUBBER AND PROTECTION AND ASSISTANCE TO THE RUBBER PLANTATION INDUSTRY*

Personnel of the Board

Dr. H. L. DEY, D. Sc. (Lond.)	...	*President.*
Dr. B. V. NARAYANASWAMY NAIDU, M. A., B. Com., Ph. D., Barrister-at-law	...	*Member.*
Mr. B. N. ADARKAR, M. A., (Cantab)	...	*Member.*
Mr. M. A. MULKY, M. Sc. (Econ.) (Lond.)	...	*Secretary.*

Personnel of the Panel which heard the case

Dr. H. L. DEY	...	*President,*
Dr. B. V. NARAYANASWAMY NAIDU	...	*Member.*

1. REFERENCE TO THE BOARD AND TERMS OF REFERENCE

(a) The Government of India, in the late Ministry of Commerce Resolution No. 3-T (3)/50 dated 27th November, 1950, (*vide Appendix I*), requested the Tariff Board to examine the costs of production of raw rubber and determine fair prices for the various grades of raw rubber and submit a Report as soon as possible. This reference was made as a result of the representations made by the Indian Rubber Board, Kottayam, which resolved at its meeting held on 7th October, 1950, that the question of the fixation of a fair price for raw rubber should be referred to the Indian Tariff Board for necessary examination. In making the reference to the Board, Government pointed out that there had been a sharp increase in the world prices of rubber and that the Indian producers had been asking for an increase in the Indian controlled prices for various grades of raw rubber as fixed by Government under section

* Reproduced with kind permission

13 of the Rubber (Production and Marketing) Act, 1947. It is stated in the Resolution that these prices had been fixed on the basis of the cost of production (as ascertained by the Government Cost Accountant) plus a reasonable margin of profit and that the controlled price was Rs. 90-8-0 per 100 pounds of Group 1 rubber, f. o. b., Cochin, with suitable differentials for other grades.

(b) While the Board had been making necessary investigations under the terms of reference stated in the late Ministry of Commerce Resolution No. 3-T (3)/50 dated 27th November, 1950, mentioned in (a) above, Government of India, in the Ministry of Commerce and Industry Resolution No. 3-T (3)/50 dated 10th February, 1951 (*vide Appendix II*), extended the Board's terms of reference to cover the question of protection to the rubber plantation industry. Government pointed out in this Resolution that the Indian Rubber Board had suggested that the Tariff Board's inquiry should be more comprehensive and should cover the question of protection to rubber for the speedy development of the industry. Government accepted this proposal and in the terms of Resolution dated 10th February, 1951, asked the Board to extend the inquiryand make recommendations to Government in regard to the following matters :—

(i) Whether the industry is established and conducted on sound business lines.

(ii) Whether having regard to the natural or economic advantages enjoyed by the industry and its actual or probable costs of production it is likely within a reasonable period of time to develop sufficiently to be able to carry on without protection or State assistance.

(iii) Whether it is feasible to remove restrictions on import of raw rubber and levy an import duty so that imported raw rubber will not sell at a price less than the fair price fixed for the Indian rubber.

(iv) Whether any special development fund should be created for the development of the industry ; and, if so, how that fund should be raised.

2. METHOD OF INQUIRY

(a) On 6th December, 1950, the Board issued a preliminary questionnaire to the Indian Rubber Board and to certain important Associations of producers of raw rubber and rubber goods and requested them to forward memoranda on the various aspects of the rubber industry in order to enable the Board to prepare detailed questionnaires to be issued to the different parties interested in the industry. On receipt of their replies, the Board issued a special questionnaire on 10th January, 1951, (*vide Appendix III*) to the producers of raw rubber, the Indian Rubber Board, Associations of producers of raw rubber and

Chambers of Commerce. Another special questionnaire was issued to the consumers (*vide Appendix IV*). The Board also requested the Chief Secretaries to the Governments of the States of Travancore-Cochin, Madras and Mysore to forward memoranda on the Indian Rubber Plantation Industry in their respective States. The D. G. I. & S was also requested to forward a memorandum on the subject of the inquiry. As the scope of the inquiry had been extended in February 1951 to cover the question of protection and assistance to the rubber plantation industry, the Board issued on 6th February 1951 another special questionnaire (*vide Appendix V*) to the different parties mentioned above. The Collectors of Customs and Messrs. Dunlop Rubber Co. (India) Ltd., were requested to furnish information regarding the latest c. i. f. prices of raw rubber. A list of firms or bodies to whom the Board's preliminary and special questionnaires were issued indicating those who replied thereto or submitted memoranda, is given in *Appendix VI*.

(b) On 10th January, 1951, the Board issued a press communique intimating that the Board would hold an inquiry to examine the question of fixation of fair prices for raw rubber and requesting persons or associations desiring to express their views on this matter to send their representations or memoranda to the Board for consideration. On 10th February, 1951, the Ministry of Commerce and Industry issued another press communique intimating that the Board would also examine during the inquiry mentioned above the question of protection to the rubber plantation industry and requesting persons or associations desiring to express their views on the subject to send their representations or memoranda to the Board for consideration.

(c) Sri R. Sundaram, Cost Accounts Officer attached to the Board, accompanied by Sri A. K. M. Pillai, Technical Adviser to the Board, visited Kottayam from 16th to 31st January 1951 and examined the costs of production of raw rubber in five estates and four small holdings.

(d) Dr. B. V. Narayanaswamy Naidu, Member, Indian Tariff Board, visited Madras on 7th February 1951 and discussed problems of the rubber plantation industry with Shri A. M. M. Murugappa Chettiar and Shri K. M. Eapen.

(e) Dr. H. L. Dey, President, Indian Tariff Board, and Dr. B. V. Narayanaswamy Naidu, Member, visited Kottayam from 8th to 10th February 1951. They visited a few rubber plantations on 9th February 1951. On the 10th February 1951 they discussed with the representatives of the Travancore-Cochin Government, the Indian Rubber Board, the Associations of the producers and others, the problems of the industry. Their programme at Kottayam on 9th and 10th February, 1951, is given in *Appendix VII*.

(f) A public inquiry was held on 19th and 20th February 1951 in the Board's office in Bombay. A list of persons who were present at the inquiry is given in *Appendix VIII*.

3. RUBBER PLANTATION IN INDIA.

* * * *

(b) The first plantations of Hevea Rubber were in the Periyar Estate in Travancore and the Poonoor Estate in Malabar. Plantations of rubber on a commercial scale may be said to have commenced in 1902. During that year, 500 acres at Thattakad, North Travancore, were granted for rubber cultivation. In 1903, 500 acres in the Koney reserve and in 1904 another 400 acres in the Periyar valley were granted for rubber cultivation. In the subsequent years the system of cultivation of rubber on a plantation scale began to spread to different parts of the South West Coast and by 1910 the area under rubber had increased to 29,500 acres and the production of raw rubber in that year was 80 tons. This small production of rubber at that time was due to the fact that the trees in most of the areas under rubber had not yet reached maturity for tapping. The high price of 12 sh. 9 d. per pound of rubber in 1910 stimulated the cultivation of rubber as a remunerative crop and more areas were brought under rubber cultivation. Though the price of rubber declined after 1910, the areas planted with rubber continued to increase and in 1925 the area under rubber was 76,295 acres and the production of rubber increased to 6,300 tons.

After 1925 statistics are available regarding the rate of planting for each year and these are given in *Appendix IX*. A statement showing the correlation between the rate of planting and the level of world prices of rubber since 1925 is given in *Appendix X*. The price of rubber per pound in 1925 fluctuated between 4 sh. 8 d. and 1 sh. $4\frac{5}{8}$ d. with an average of 2 sh. $10\frac{3}{4}$ d. Even at this price the cultivation of rubber was still considered as the most remunerative agricultural crop at that time and there was therefore a further increase in the area under rubber and the new planting in 1926 covered 23,406 acres being about a third of the total of the then existing area under rubber and the highest area brought under rubber cultivation in any single year during the whole period of the Indian rubber plantation industry as will be seen from the statistics given in *Appendix X*. A noticeable feature of this increase in the area under rubber was that more than 17,000 acres were small holdings of less than 100 acres each (*vide Appendix IX*). It would appear from this that the highly remunerative prices of rubber in that year attracted many small agriculturists to go in for rubber planting.

During the period from 1926 to 1929 there was a progressive increase in the area under rubber and it will be seen from *Appendix IX* that the trend was for an increase in the acreage under small holdings than in estates. In 1930, however, there was a slump in the prices of all agricultural commodities and in 1932 the price of rubber came down to the unprecedented low level of $1\frac{1}{16}$ d. and during that and the subsequent year the increase in the area under rubber was very small. In 1934, however, the International Rubber Regulation Agreement came into operation whereby production and new planting of rubber was restricted and regulated. As a result of the operation of this Agreement the prices of rubber began to increase and new planting of rubber in India which had been negligible in 1933 and 1934 also began to increase

during the subsequent years to the extent permitted by the International Agreement.

It will be seen from what has been said above that the general trend was to bring more areas under rubber when the price was satisfactory. But for the restriction of new planting imposed by the International Rubber Regulation Agreement, the rate of plantings of rubber during the restriction period would have followed the trend of prices more closely. The onset of World War II in 1939 however changed the situation. By 1942 most of the important rubber producing countries in South East Asia had been invaded and occupied by Japan and about 90 per cent of the world's normal source of natural rubber was cut off. As a result of this, India and Ceylon remained the only sources of natural rubber for the Allied Nations and the rubber growers in these countries were strenuously encouraged to produce the maximum rubber required for the prosecution of war. Restrictions on production and planting of rubber were removed in 1942 and there was therefore considerable activity in new planting and replanting which in 1943 covered 14,599 acres, the largest increase in any one year since 1926. The prices of rubber did not however increase considerably due to the control of prices by Government. In 1944 and 1945 the increase in the area under rubber was 11,108 and 8,933 acres but since then there has been a decline in the rate of planting and in 1949, it was only 969 acres.

The total area under rubber at the end of 1949 was 1,69,425 acres and the production of rubber in that year was 15,587 tons. In 1950 the production of rubber was only 15,599 tons and this is attributed to adverse weather conditions and the wide disparity between internal and external prices. The progress of new planting has also slowed down to some extent as the planters preferred to grow other remunerative crops.

Causes for the fall in the rate of planting :—

The producers have stated the following reasons for the fall in the rate of planting :—

(i) increase in cost of cultivation as a result of increase in wages, cost of foodstuffs and other materials.

(ii) high incidence of Agricultural income-tax and sales tax.

(iii) inadequate increase in the prices of rubber in the post war period as compared with the increases in the prices of other agricultural crops such as paddy, tapioca, coconut, pepper, coffee, tea etc. as a result of which the rubber growers do not have sufficient incentive to plant rubber in preference to other crops. In this connection, the producers have referred to the index numbers of wholesale prices of different agricultural commodities for the week ended 2nd September 1950 which is given in *Appendix XI* and from which it will be seen that the price of rubber has increased the least.

(iv) high cost of new planting and replanting at the present cost of labour and materials.

(v) fear of competition from synthetic rubber.

On account of these reasons, the producers have stated that at the present Indian controlled price of rubber, they are not able to obtain any profits and that even in the case of the small proportion of estates which do make some profits, the margin is not sufficient for re-investment in rubber planting.

It is further stated that owners of small estates and small holdings have been most affected by the present low prices of rubber as they generally depend on the income from rubber for their living and in many cases they are reported to have cut down rubber trees for the purpose of using the land to cultivate other crops.

(c) The Table given below shows the geographical distribution of rubber cultivation in the different regions in India at present:—

Table

(Source:—Indian Rubber Board)

Region	No. of estates (of and above 100 acres)	No. of holdings (below 100 acres)	Area (in acres)	Percentage of total area.
Travancore	165	13268	122,493	72·30
Cochin	14	178	13,767	8·13
Malabar	57	143	26,655	15·73
Mysore	2	5	396	0·23
Rest of India	15	16	6,116	3·61
Total	253	13610	169,427	100·00

It will be seen from the above figures that Travancore accounts for a very large area of 122,493 acres forming 72·30 per cent of the total acreage under rubber. From the point of view of the acreage and the labour employed in the industry, rubber is rather important in the rural economy of Travancore. The remaining area under rubber is distributed in Cochin (8·13 per cent), Malabar (15·73 per cent), Mysore (0·23 per cent) and the rest of India (3·61 per cent).

* * * *

15. BOARD'S ESTIMATE OF COSTS OF PRODUCTION AND FAIR SELLING PRICES FOR RUBBER

(1) Estates and holdings selected for costing:

In consultation with (i) the Rubber Production Commissioner, (ii) the representatives of the planters' associations and (iii) several representatives of estates and small holdings, the following five estates and four holdings were selected for costing as representative units:

Estates

Serial No.	*Name of the estate*	*Area in acres*	*Yield per acre in 1949-'50*
(1)	Kolamala	241·91	240
(2)	Mundakayam	3079·60	301
(3)	Sittar	1003·08	330
(4)	Shaliacary	1496·69	534
(5)	Vellapara	252·00	397
Small holdings			
(1)	Kanakapuram	11·00	100
(2)	Kaduparambil No. 1	21·00	150
(3)	Kaduparambil No. 2	21·00	150
(4)	Kuttikayam	18·00	150

In addition to the above, the following estates were selected for working out the costs for new planting and replanting:

Name of estate	*Area in acres*	
Nenmeny	100	New planting
Rajagiri	75	
Ambanad	48·5	
Rajagiri	35	Replanting
Ambanad	34·75	

(2) Scope of cost investigation

The fair price for raw rubber, f. o. b. Cochin, will be made up of (a) the cost of production of raw rubber in the form of smoked sheets and their transport to Cochin, comprising

(i) maintenance and upkeep of a mature estate ;

(ii) tapping and collecting of latex ;

(iii) manufacture of plain smoked rubber sheets ;

(iv) general charges, estate and Head Office ;

(v) Packing charges ;

(vi) cost of transport from the estate to Cochin, and

(vii) rubber cess ;

(b) interest on working capital ; (c) depreciation on plantation or rehabilitation instalment ; (d) return on capital ; (e) managing agency commission ; (f) provision for taxation ; and (g) provision for suitable differentials between various grades of rubber.

(3) Period of costing.

For the purpose of ascertaining the cost of production, namely, item (a) of (2) above, the actual costs for the past three years, viz., 1947—48, 1948-49 and 1949-50 were examined.

In order to arrive at the depreciation instalment to be provided, cost data were obtained in respect of new planting and replanting in estates by going as far back as 1939.

(4) Unit of costing

To facilitate easy comparison of prices, " 100 lbs." has been adopted as the unit.

(5) Nature of cost data available

All the estates costed are either rubber-cum-tea estates or pure rubber estates. Detailed financial accounts are maintained at these estates and are regularly audited. The system of accounts maintained in this plantation industry is satisfactory in as much as all the expenditure is collected in as great a detail as possible, with the result that it is possible to arrive at fairly good estimates of the cost of production for any particular section of this industry. It is, however, felt that there is considerable scope for improvement in the accounting system to be adopted. One item which is treated differently by different estates is the question of absorbing the costs of replanting. Some are treating it as revenue while others put it as capital. As regards new planting costs, all expenses incurred in opening a new clearing and maintaining it up to the bearing stage are treated as capital costs by all the estates. For the purpose of this investigation, all costs relating to new planting and replanting have been excluded from the basic costs and are given separate treatment. In doing so, the proportion of general overheads and other charges applicable to these new planting and replanting sections have also been excluded. The respective estate managements agreed to this method.

(6) Comments on cost data collected from estates

Schedule 1 attached at the end of this paragraph shows the comparative costs of production for the past 3 years in respect of all the estates costed. As the firms requested that the details of cost of production should be treated as confidential these details are not given in this Report. They are, however, being forwarded to Government as a separate confidential enclosure to this Report. The following comments are offered on the main items of cost of production.

(a) Maintenance and upkeep

This represents the cost incurred for weeding, manuring (wherever done), prevention of pests and diseases, growing of cover crops, spraying (wherever done), marking of temporary boundaries, etc. It may be noted that, in the case of some estates, manuring and spraying were not done during the period under investigation, whilst in the case of certain other estates either spraying or manuring was only done, (*vide* foot-note under Schedule 1). The industry represented strongly that whatever was done by way of manuring, spraying, etc., in the various estates was not sufficient to maintain the estates under optimum conditions and that these estates really required more care and attention.

(b) Tapping and collection

This comprizes chiefly the cost of labour for tapping the latex and that of small implements, such as knives, etc., used in tapping. In certain cases, a small amount of transport cost is also incurred for conveying the latex from the estate to the factory.

(c) Manufacture of sheets

Under this head are included the cost of various chemicals used, such as formic and/or acetic acids, in coagulating the latex as well as the cost of fuel for drying the sheets and the cost of incidental labour. In arriving at the cost for the sheeting process, necessary adjustment has been made in the case of estates where crepe sole and other allied varieties are made.

(d) General charges

These consist of general charges incurred (i) on the estate and (ii) in the Head Office. In the case of one sterling Company examined, the Head Office expenses included also those of its London Office. The position is explained below :—

(i) *Estate Overheads*

Under this head are shown all the charges incurred in connection with the running of the estate together with all the payments made to the workers and staff. The latter comprizes all payments and expenses incurred, such as those for district allowance, tripartite district allowance, loss incurred on food-grains, labour engagement expenses, travelling expenses given to workers, medical expenses incurred for workers, holiday pay to workers, and expenses for running the school for workers' children and feeding them. Examination of the "estate general charges" for 1949-50 shows that the proportion of the various disbursements or expenses incurred in connection with the running of the estate as above form 52 to 59 per cent of the total charges. The disbursements made to clerical staff form 9 to 13 per cent. The balance only represents real estate general charges.

(ii) *Head Office expenses*

In the case of Head Office charges, all the expenses of the management have been taken into account and necessary credit has been given in respect of shares to be allocated to new or replanting sections. In working out the Head Office expenses, provision has been made in respect of Managing Agents' Office allowance, wherever it is paid, and depreciation on buildings, machinery, etc., used in the various estates, according to the income-tax rates. No provision has been made in respect of Managing Agency Commission and selling commission. In the case of one Company investigated, the selling commission is paid separately at the rate of $1\frac{1}{2}$ per cent on the nett price realized; whilst in the case of other Companies no selling commission is paid separately.

(e) Packing charges

This is made up of the cost of gunnies and that of packing labour. In the case of one estate costed, packing is done under a contract

entered into between the estate and its agents, who charge a fixed price per unit packed.

(f) Transport from estate to Cochin

The actual charges incurred in the various estates costed are tabulated under each head and they vary according to the distance from the respective estates to Cochin, involving either land or water transport.

(g) Export duty

This represents the export duty paid until August, 1949, to the Travancore State at the rate of Rs. 1/8/- per cwt. on all rubber exported. This duty was abolished after August, 1949.

(h) Rubber Cess

This is collected and paid to the Indian Rubber Board at the rate of 8 annas per 100 lbs. from August, 1949.

The total cost comprizing items (a) to (h) above is the basic cost of production of rubber inclusive of cost of delivery, free on board, in Cochin.

(7) Average cost for estates

Figures of the final prices calculated together with the individual yields and the average worked out for the five estates costed, are given below for the latest period, viz., 1949-50.

Estate.	*Cost per 100 lbs.*	*Yield in lbs.*
	Rs.	
1. Kolamala	52·00	240
2. Mundakayam	60·77	301
3. Sittar	60·09	330
4. Vellapara	75·29	397
5. Shaliacary	44·95	534
Average	58.62	360

The simple average price for the estates costed is Rs. 58.62 per 100 lbs. based on an average yield of 360 lbs. It may be noted that the average yield for all estates and holdings taken together was 282 lbs. in 1949. Having regard to this fact, we have adopted an average yield of 350 lbs. per acre for purposes of distributing certain overheads, such as interest, return on fixed capital, etc.

(8) Cost data for small holders

Data were collected in respect of four small holders covering acres 11, 21, 21 and 18 respectively. Although the small holders affirmed that the data represented the actual expenses incurred by them, the figures appear to be highly inflated for they do not stand any comparison with the costs obtained for the estates. Normally, the cost of production in a small holding should not be higher than that in an estate,

considering that it does not incur high overheads and establishment charges as in the case of estates. Besides, most of the work in small holdings is done by the members of the holders' family. In addition, very little upkeep or maintenance expense is incurred. The only handicap is that the yield from these small holdings is lower than that from the estates. The estimates given by the small holders for two groups of estates were Rs. 122·86 and Rs. 129·57 respectively per 100 lbs. or an average of Rs. 126·22 per 100 lbs. These figures cannot be regarded as accurate, as most of the small holders do not maintain any detailed accounts. Consequently, we have not accepted them for the purpose of building up the price for the industry as a whole. In the public inquiry, the question was discussed whether it would be advisable to leave out the smaller estates and take into account only the estates. It was ultimately decided that, in the interest of maintaining the present output of rubber and also at the same time to create incentive for these small holders to improve their methods of working, an extra allowance might be made for the small holdings. It is important to note that the small holdings occupy 40 per cent of the area under rubber and contribute 28 per cent of the total rubber produced in India. The extent to which this extra should be allowed was also discussed and the industry suggested that it should be of the order of 15 per cent. We, however, consider that an extra allowance of 10 per cent on the cost for estates should provide sufficient incentive for the small holders.

(9) Formula for working out the cost for the industry

At the public inquiry, it was suggested that the weighted average of the two separate prices to be arrived at as mentioned above for the estates and small holdings based on the actual total production ratio of 72 per cent and 28 per cent respectively might be taken as the representative average for the industry as a whole. The average cost for the five costed estates works out to Rs. 58·62 for 100 lbs. and with an extra allowance of 10 per cent for small holders, the representative cost for the small holders works out to Rs. 64·48. Applying the production ratio of 72·28, the weighted average of these two prices comes to Rs. 60.26 as per details given below :—

Rs. 58.62 × 0.72 = Rs. 42.21

Rs. 64.48 × 0.28 = Rs. 18·05

= Rs. 60·26

(10) Extras for 1951

Based on the figure of Rs. 60·26 for the year 1949-50, the Board has to build up the estimate of cost for 1951 after taking into account all the factors required for maintaining an estate under optimum working conditions. At the public inquiry, the industry claimed that adequate provision should be made for the following four items of expenses in arriving at the cost of production for 1951, viz. (a) Spraying, (b) manuring, (c) growing of cover crops and (d) dusting with sulphur. Each of these items is discussed below :

(a) Spraying

It has been already pointed out in 6(a) of this paragraph that very little spraying was done during the past two or three years. The consensus of opinion of the plantation industry and also of the manufacturers was that adequate provision should be made in the costs to cover expenses for spraying with chemicals to prevent the extra shedding of the foliage after the advent of the South-West monsoon when the trees are liable to attack by special leaf diseases. Various figures were given for this purpose. Based on the latest costs of spraying incurred in one of the estates costed, the amount comes to Rs. 37·4 per acre yielding about 400 lbs. of rubber. This works out to Rs. 9·35 per 100 lbs.

(b) Manuring

Considerable discussion took place as to whether it was necessary to manure old rubber, as the effects of manuring were stated to be not immediately visible in the form of increased yield. Consequently, it was considered uneconomical to manure old rubber. But at the same time, it was stressed that manuring should be done in the case of estates containing newly planted rubber, under yielding stage. Statistics maintained by the Rubber Board showed that such types of estates under yielding stage comprize only 15 per cent of the total rubber area. Cost of manuring works out to Rs. 90·60 per acre based on the latest actuals incurred by one of the estates costed. This will, however, be required for only 15 per cent of the acreage, and the expected yield is 500 lbs. per acre. On this basis, the cost of manuring works out to Rs. 2·72 per 100 lbs.

(c) Growing of cover crops

At the public inquiry, the industry stressed that growing of cover crops was the only economical way of maintaining the fertility of old rubber. Cover crops are considered essential in that they give the necessary nitrogenous manure to the rubber trees. Full cost data in respect of this item were not available as most of the estates had not grown cover crops to the extent required. Consequently, several estimates were put forth varying between Rs. 2-8-0 to Rs. 5-0-0 per acre and we consider that Rs. 3-8-0 may be taken to represent this cost. As most of the rubber requiring these cover crops will be of the old type yielding about 350 lbs. per acre (Vide 15(7) above), the cost per 100 lbs. will work out to Re. 1·00.

(d) Dusting with sulphur

Two diseases to which the foliage of the rubber tree is susceptible are Phytophthora and Oidium. The former is obviated by spraying and the latter by dusting with sulphur. The latter disease was imported into India in 1947 and its effect is now rather seriously felt in certain areas of Travancore-Cochin. We have been informed that at least 50 per cent of the estates will be affected by this disease. The cost per acre for sulphur dusting is estimated at Rs. 25/- and applying 50 per cent ratio, the cost per acre will be Rs. 12·5. The yield expected from

such estates will be about 350 lbs. and this will give the cost of dusting per 100 lbs. at Rs. 3·57.

The total of these four extras, (a) to (d) above, will come to Rs. 16·64 per 100 lbs.

(e) Increase in labour cost due to extra dearness allowance etc. to be paid

In the case of three estates, Tripartite District Allowance is paid at a rate lower than that paid in other estates. As in 1951 these estates will also be forced to pay at the same general rates, necessary adjustment has to be made in the estimate for the consequent increase in labour costs of these estates. This has been found to work out to Rs. 1·02 per 100 lbs. based on the average for all the estates costed.

Total extras to be provided will work out to Rs. 17·66 (16·64 plus 1·02). The amount already provided in the 1950 costs comes to Rs. 7-0-0 per 100 lbs. The nett extras required, therefore, will be Rs. 10·66. We consider it reasonable to allow for these in arriving at the cost for 1951 for the industry. Adding this figure of Rs. 10·66 to the figure of Rs. 60·26 already worked out in (9) of this paragraph the total cost for the industry will be Rs. 70·92 per 100 lbs. (Vide Schedule II attached at the end of this paragraph).

(11) Interest on working capital

At the public inquiry, the producers of raw rubber and the manufacturers of finished goods agreed that interest on working capital should be provided separately. We have taken the working capital as equivalent to three months' cost of production. Although it is the normal practice of the Board to allow interest on working capital at 4 per cent, in the public inquiry there was enough evidence to show that the industry was not able to raise any short-term funds at less than 6 per cent. Some stated that the rate of interest goes even higher than 6 per cent. We are convinced of the special difficulties encountered in raising funds in South India where the rubber industry is concentrated. We have, therefore, allowed a slightly higher rate of interest, viz., 5 per cent against the industry's demand of a minimum of 6 per cent. Based on that, the cost will work out to Rs. 0·89 per 100 lbs.

(12) Depreciation or Rehabilitation fund

The Cost Accounts Officer examined the cost for new planting in four estates and those for replanting in one estate. The figures obtained for new planting vary from Rs. 933 to 1,542 per acre to bring an estate into mature stage from the time of opening up the land. In the case of replanting, it was Rs. 959. At the public inquiry, many figures were suggested varying from Rs. 1,500 to Rs. 3,000. The industry wanted an average of Rs. 1,400 to be taken as a representative cost for this purpose. At the inquiry, the industry was referred to the report of the Development Committee wherein it had been stated that the cost of replanting in the past decade had varied from Rs. 750 to Rs. 1,000 per acre. The Rubber Production Commissioner also pro-

duced certain figures showing the latest costs available in this connection varying from Rs. 658 to Rs. 1,425 per acre. Based on the figures given by the Rubber Production Commissioner and taking into account the fact that we have also to provide for the increase in costs during the next decade we have estimated the cost of rehabilitation at Rs. 1,200 per acre. Making an allowance for the credit of Rs. 200 to to be realized as revenue by cutting old trees for fuel purposes (100 trees per acre at Rs. 2 per tree), the nett cost per acre for rehabilitation purposes will work out to Rs. 1,000. The effective tapping life of a rubber tree has been estimated at 30 years. The average yield expected during this period will be 750 lbs., based on the figures given in the Development Committee's report. Working on the above lines, the rehabilitation cost per 100 lbs. will amount to Rs. 4·44.

It was pointed out that this amount should go into the cost of production and should be treated in the same way as depreciation is treated in the case of industrial concerns. We have been informed that the Travancore-Cochin Government do not allow this amount as an item of expenditure in assessing the estate revenue for income-tax purposes. If this is a fact, the object for which this depreciation is allowed will be frustrated. The reasons for which this could not be allowed as a charge against assessable income are not known. If for any special reasons this position could not be reviewed in favour of the industry, necessary provision for income-tax on this amount must be made to enable the industry to derive this benefit. Based on the existing rates of tax, the corresponding provision for taxation required will work out to Rs. 2.38 per 100 lbs. The total amount so required to be provided amounts to Rs. 6.82 (Rs. 4.44 plus Rs. 2.38) per 100 lbs.

(13) Estimate of the fixed capital employed in the industry

The usual practice is to allow return at a percentage on the original value of the total block employed in any industry. From a scrutiny of the accounts, it is found that the basis of valuation of land for development etc., adopted by all the estates is not really scientific. It is, therefore, possible that any value fixed on the basis of such accounts may not represent the correct position. We, therefore, considered that the only other alternative would be to take the paid-up capital as the basis to arrive at a reasonable figure for this purpose. Examination of the published accounts of five of the estates costed gives the following figures :—

Name of Estate	*Nature of Estate*	*Paid-up capital per acre of mature area.*
		Rs.
1. The Nenmeny Rubber & Produce Co., Ltd.,	Rubber	875
2. Udayagiri Rubber Co., Ltd.,	,,	701
3. The Midland Rubber & Produce Co., Ltd.,	Tea-cum-Rubber	1,581
4. The Rajagiri Rubber & Produce Co., Ltd.	Rubber	1,540
5. Nelliampathy Tea & Produce Co., Ltd.,	Tea-cum-Rubber	1,259
	Average	1,191

It will be seen that the paid-up capital per acre of mature plantation area works out to Rs. 1,191. This has been rounded off to Rs. 1,200 per acre against the demand of the industry varying from Rs. 1,500 to Rs. 3,000. This amount of Rs. 1,200 per acre is taken to represent the fixed capital of the Industry.

(14) Return on capital

The Chairman of the Indian Rubber Board suggested that the rate of return should be at least 15 per cent. At the informal conference held at Kottayam, the representatives of the rubber plantation industry claimed that the rate of return should be adequate to allow the payment of tax-free dividends at the rate of 14 per cent on the paid-up capital. In support of this claim, they pointed out that certain other plantation industries, such as coffee and tea, had been obtaining very high rates of profits. It was also pointed out that the rubber manufacturers in the country had been making large profits, which had enabled them to declare high rates of dividends and also build up strong reserves. We have carefully considered these suggestions. Having regard to the fact that the rubber plantation industry, like all other agricultural industries, is subject to the hazards of variations in rainfall, plant diseases, etc., over which the industry has no control, we consider that there is justification for allowing a higher rate of return in this case than is normally provided in the case of manufacturing industries. In the case of many war-time industries as well as for the sugar industry, we have allowed return at 10 per cent on the block. And we consider that it is reasonable to allow gross return in this case at the rate of $12\frac{1}{2}$ per cent on the paid-up capital, which has been taken here to be the fixed capital of the

Industry. On a paid-up capital of Rs. 1,200 per acre, the amount of return comes to Rs. 150. The estimated yield is 350 lbs. per acre. On this basis, the amout of return per 100 lbs. comes to Rs. 42·86. It may be noted that out of this amount of gross return, the estates will have to provide for (a) Managing Agency Commission, (b) dividends to share-holders, (c) reserves and (d) taxation.

(15) Provision for sales tax

The present rate of tax is Re. 0-0-3 per Rupee. In the case of certain estates, where the rubber sales are effected through dealers, sales tax is paid at two points at Re. 0-0-3 per point. As the price fixed for rubber is inclusive of sales tax, provision has to be made for the amount of sales tax payable. We have examined this question and are satisfied that it is sufficient to provide for this tax at only one point. The consequent amount that will be necessary will work out to Rs. 1·90.

(16) Average price for rubber

The amounts provided under the foregoing items make a total of Rs. 123·39 (*vide* Schedule II below). This price of Rs. 123·39 is the average for 100 lbs. of different grades. It was the consensus of opinion of the manufacturers and the producers that the average price so arrived at would represent the price for grades RMA III and IV. The difference in levels of prices now maintained between the top grade and the average of the RMA III and IV grades is Rs. 4·75. It was suggested at the public inquiry that the same differential should be maintained in fixing the price for the top grade for the future also. We consider that this is reasonable. Adding this extra differential of Rs. 4·75, the price for No. 1 grade will work out to Rs. 128 (vide Schedule II) as against the existing price of Rs. 90·5 per 100 lbs. The corresponding prices for other grades of rubber are shown in the Schedule in paragraph 16 below.

SCHEDULE—I.

STATEMENT SHOWING COMPARATIVE COSTS OF PRODUCTION PER 100 LBS. OF RAW RUBBER

Financial Year	1947—48.					1948—49.					1949—50.				
Name of Estate	Mund.	Shali.	Sittar.	Vellap.	Kola.	Mund.	Shali.	Sittar.	Vellap.	Kola.	Mund.	Shali.	Sittar.	Vellap.	Kola.
Total area in acres.	3080	1497	1003	252	242	3080	1497	1003	252	242	3080	1497	1003	252	242
Total rubber mature area.	2738	1294	891	125	165	2738	1294	891	125	165	2738	1294	891	125	165
Average Yield in lbs.	302	321	270	324	260	306	403	270	361	278	301	534	330	397	240
	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
1. Maintenance and Upkeep	8·11	3·34	1·72	4·66	*9·20	5·70	5·11	2·89	*19·85	17·94	7·97	3·65	3·48	*17·98	*11·81
2. Tapping & collection.	8·65	7·80	8·26	§18·70	10·67	8·45	7·46	8·29	§18·16	8·34	7·61	6·86	8·49	§11·38	9·14
3. Manufacture of Sheets.	4·40	6·08	4·58	5·73	3·05	3·87	4·79	4·95	6·62	2·44	3·73	3·54	4·18	5·49	2·77
4. **General Charges:**															
(a) Estates**	37·75	22·52	28·59	19·87	17·08	36·84	26·11	32·93	19·86	17·55	36·06	21·12	34·11	23·60	17·54
(b) Head Office	1·52	8·58	5·10	11·48	4·71	1·52	6·41	4·91	10·81	4·93	1·52	5·17	4·90	10·69	5·51
5. Packing.	0·75	0·85	0·65	0·56	1·91	0·77	1·10	0·64	0·75	2·41	0·88	1·20	0·89	0·73	2·63
6. Transportation from Estate to Cochin.	2·68	2·63	3·53	2·47	2·41	2·72	3·09	3·54	2·78	2·22	2·50	2·79	3·16	4·83	2·10
7. Export Duty.	...	1·65	1·59	0·20	1·24	...	1·90	1·89	0·47	0·70	...	0·12	0·38	0·09	...
8. Rubber Cess.	0·50	...	...	...	...	0·50	...	...	...	...	0·50	0·50	0·50	0·50	0·50
9. Total cost f. o. b. Cochin.	66·36	53·45	54·02	63·67	50·27	60·37	55·97	60·04	79·30	46·53	60·77	44·95	60·09	75·29	52·00

Abbreviation.	*Full Names.*
Mund.	Mundakayam.
Shali.	Shaliacary.
Vellap.	Vellapara.
Kola.	Kolamala.

* includes spraying.
‡ ,, manuring.
§ D. A. and T. D. A. included in wages.
** includes allowances to workers and staff.

SCHEDULE II

STATEMENT SHOWING ESTIMATED COST PER 100 LBS. OF RAW RUBBER FOR 1951.

		Rs.
1.	Average of actuals for the five estates for 1950	58·62
2.	Estimate for small holders	64·48
3.	Weighted average for the industry (i. e. 1 and 2 above)	60·26
4.	Nett extras to be added for 1951	10·66
5.	Cost of production for 1951	70·92
6.	Interest on working capital at 5% on 3 months' cost of production	0·89
7.	Rehabilitation fund instalment	6·82
8.	Return at 12½% on fixed capital	42·86
9.	Total cost f. o. b. Cochin	121·49
10.	Provision for sales tax at Rs. 0-0-3 per rupee on (9)	1·90
11.	Total price for R. M. A. III & IV Grades F. O. B. Cochin	123·39
12.	Adjustment for differential for top grade	4·75
13.	Price for Grade I Rubber	128·14
		Say Rs. 128/-

16. Schedule of fair selling prices of different grades of rubber.

The fair selling price, f. o. b., Cochin, for grade R. M. A. No. 1 rubber comes to Rs. 128/- per 100 pounds. Based on this fair selling price for R. M. A. No. 1, we have worked out the schedule of prices for all grades of rubber. The Schedule is as follows :—

Statement showing maximum and minimum prices for various grades and qualities of rubber mentioned below.

		F. O. B. COCHIN for 100 lbs.	
		Maximum price	Minimum price
		Rs. as. p.	Rs. as. p.
Group 1	R. M. A. IX	128 0 0	127 0 0
	R. M. A. 1	128 0 0	127 0 0
Group 2	R. M. A. 2	126 8 0	125 8 0
	R. M. A. 3	125 0 0	124 0 0
	Cuttings No. 1	117 8 0	116 8 0
Group 3	R. M. A. 4	121 8 0	120 8 0
	R. M. A. 5	117 8 0	116 8 0
	Cuttings No. 2	111 8 0	110 8 0
Group 4	Precoagulated Crepe	133 8 0	132 8 0
	Pale Latex Crepe IX	131 8 0	130 8 0
	Pale Latex Crepe 1	129 8 0	128 8 0
	Pale Latex Crepe 2	128 8 0	127 8 0
	Pale Latex 3 FAQ	127 8 0	126 8 0
Group 5	Estate Brown Crepe 1X	119 8 0	118 8 0
	Do. 2X	116 8 0	115 8 0
	Smoked Blanket	119 8 0	118 8 0
	Remilled Crepe 2	112 0 0	111 0 0
Group 6	Estate Brown Crepe 3X	108 8 0	107 8 0
	Remilled Crepe 3	105 8 0	105 8 0
	Do. 4	101 0 0	100 0 0
Group 7	Flat Bark	92 8 0	91 8 0
	35% Normal Latex (excluding cost of container)	129 0 0 plus a premium of Rs. 17-8-0 per 100 lbs. of DRC	128 0 0 plus a premium of Rs. 17-8-0 per 100 lbs. of DRC
	50 to 55 % concentrated preserved latex (excluding cost of container)	129 0 0 plus a premium of Rs. 43-0-0 per 100 lbs. of DRC.	128 0 0 plus a premium of Rs. 43-0-0 per 100 lbs. of DRC.

17. Additional terms of Reference and the Implications thereof.

As required by our original terms of reference (vide Government Resolution of 27th November, 1950) we have investigated the costs of production of raw rubber in the country and in paragraph 16 above have recommended a schedule of fair selling prices for different groups of raw rubber. In this connection it may be pointed out that the object of fixing fair selling prices for indigenous raw rubber under Section 13 of the Rubber (Production and Marketing) Act, 1947 was to safeguard the position of the raw rubber industry against the possible competition of imports of low-priced rubber. With this object in view Government fixed fair selling prices for indigenous rubber from time to time. Such fair selling prices had been determined after considering the cost estimates made by the Government's Cost Accounts Officer. These statutory prices included a reasonable provision for profits so as to give the necessary incentive to the producers to continue to produce rubber. Moreover, in order to ensure that such fair prices become effective, Government regulated imports of rubber into the country, licences for imports being issued after consideration of the recommendations of the Indian Rubber Board [vide section 8 (3) (a) of the Rubber (Production and Marketing) Act, 1947.] The object of import regulation, presumbly, was to limit imports as far as practicable to the quantum required to fill up the gap between the indigenous supply and demand. As indicated in paragraph 8 above the policy of import control together with fixation of statutory prices had enabled the rubber producers to realize prices substantially above the world prices of rubber. The advantage of a higher price in favour of the Indian producers prevailed until March, 1950. The margin of price advantage enjoyed by the Indian rubber producers varied from Rs. 3·25 per 100 lbs. (as in October-November, 1947) to Rs. 38·25 per 100 lbs. (as in June, 1949). Since April 1950, however, owing to an abnormal increase in demand for purposes of stock-piling and rearmament in the U. S. A. and other countries the world price of rubber has been rapidly going up, the margin in favour of the world price as against the Indian price being as high as Rs. 214·88 per 100 lbs. in November, 1950. The Office of the Indian Rubber Board has furnished to us a statement of comparative prices of rubber in India and in the world market during the period from October, 1947 to December, 1950. The statement is reproduced in *Appendix XXXIV*. In this statement it has been shown that whereas during the period of 2½ years from October, 1947 to March, 1950 the total amount of price advantage gained by the Indian rubber producers came to Rs. 147 lakhs, during the period of 9 months from April, 1950 to December, 1950 they suffered a price disadvantage amounting to a total of Rs. 332 lakhs. It will be seen that according to this statement the net price disadvantage suffered by the Indian rubber growers over the entire period from October, 1947 to December, 1950 comes to Rs. 185 lakhs. On the basis of this balance sheet of gain and loss, it has been contended by the representatives of the rubber producers that the policy of protection for indigenous rubber by way of import control and fixation of statutory

prices, has resulted in a substantial disadvantage to the Indian raw rubber industry. They have, therefore, suggested that price control for rubber should be withdrawn with a view to enabling them to derive the advantage of the abnormally high prices for rubber now ruling in the world market. In this connection they have stated that if they are allowed to sell rubber at the high prices prevalent in the world market at the present time they will be able to obtain sufficiently large funds to carry out a programme of rehabilitation, which would increase the yield and reduce the cost of production and thereby place the industry in a position to meet foreign competition when the present boom would have disappeared. They have further stated that if they are allowed to derive the benefit of the present world price of rubber they will be able to build up strong reserves which should assist them in meeting competition of low-priced foreign rubber when normal conditions return. In support of this contention they have pointed out that although until October, 1947 the industry had not received any special assistance from Government by way of protection or statutory fixation of prices at a level higher than the world price, it had not only survived foreign competition for a period of over 30 years but also carried out considerable extension and improvements in rubber cultivation. In the light of this past experience, the European section of the industry has claimed that if protection-cum-control of rubber is withdrawn the industry would be able to consolidate its financial position during the present boom and stand on its own legs in the subsequent years. This claim is largely supported by the representatives of the Indian section of the industry but they have additionally suggested that if and when the world prices of rubber decline to a level appreciably below the cost of production in this country, protection should be given to indigenous rubber through the normal method of imposition of import duties. It was on the basis of such a suggestion that Government decided to expand our terms of reference for this inquiry, so as to "cover the question of protection to rubber for the speedy development of the industry."

The additional terms of reference have been stated in paragraph 3 of the Ministry of Commerce and Industry Resolution No. 3-T (3) 50, dated 10th February 1951. In accordance with these terms, the Board has to inquire and report to Government in regard to the following matters :—

(a) Whether the industry is established and conducted on sound business lines.

(b) Whether having regard to the natural or economic advantages enjoyed by the industry and its actual or probable costs of production, it is likely within a reasonable period of time to develop sufficiently to be able to carry on without protection or State assistance.

(c) Whether it is feasible to remove restrictions on import of raw rubber and levy an import duty so that imported raw rubber will not sell at a price less than the fair price fixed for the Indian rubber.

(d) Whether any special development fund should be created for the development of the industry, and if so, how that fund should be raised.

It will be noted that clauses (a) and (b) relate to the question whether the raw rubber industry satisfies the conditions of eligibility for protection or State assistance and (c) relates to the question whether protection to the industry against competition from imports, if and when it is justified, can suitably be given by means of an import duty. We shall now deal with these three clauses of the terms of reference.

18. The Industry is established and conducted on a sound basis.

From the study of the history of rubber cultivation it would be seen that in a period of 40 years from 1910 to 1950 the area under rubber has increased from 29,500 acres to 169,427 acres, and the production of rubber from 80 tons per annum to about 16,000 tons per annum. Moreover at the present time about 19 per cent of the acreage under rubber has been put under high yielding plants which compares favourably with the progress made in this respect in Malaya. It may be noted that until 1947 this development had been entirely based upon private enterprise without the benefit of any significant assistance from the State. It may also be pointed out that the expansion of rubber production in the country had taken place in the face of acute competition from the stronger and better organised rubber growers in Malaya, Indonesia and Ceylon. It may also be mentioned that the growth of the industry has been fairly continuous in spite of several recurring periods of abnormally low prices brought about by excessive supplies in the world market. Moreover about 72 per cent of the production is contributed by estates and many of these estates are managed by several plantation companies of long standing and good reputation. In the light of these notable facts about its past development, it is reasonable to conclude that the industry is on the whole established and conducted on sound business lines.

19. No need for protection at the present time

As has been stated earlier, since April 1950 owing to an abnormal rise in the demand for rubber for purposes of stockpiling and rearmament the world price of rubber has gone up and is now much higher than the Indian price of rubber. The average price for rubber RMA 1 FOB Colombo during the quarter October-December 1950, for instance, was Rs. 269·84 per 100 lbs. The estimated fair selling price for indigenous rubber RMA 1 FOB Cochin is Rs. 128 per 100 lbs. These figures show that there is no need for protection to indigenous rubber at the present time and this position will continue so long as the world price of rubber continues to be higher than the estimated fair selling price for Indian rubber. The representatives of rubber growers in the country informed us that they expected the price of rubber in the world market to continue to remain high for at least two years more. Some of the representatives of the rubber manufacturers however thought that the present abnormal demand for rubber and the consequent high price

for it would only last for a short period and that after some time the price of rubber was likely to go down to a considerable extent. We do not have adequate data at the present time to be able to make a definite forecast regarding the trend of rubber prices in the next one or two years. We, however, consider it not improbable that the world price of rubber may continue to be higher than the estimated fair selling price for indigenous rubber for a few months more. For this period, therefore, the question of protecting indigenous rubber from the competition of foreign rubber by levying an import duty or by restricting imports of rubber is not likely to arise.

20. Alternative Methods of Protection if and when necessary.

As we have stated earlier, it is not possible at the present time to make any forecast about the future trend of rubber prices in the world market. Assuming however that after a year or so, the world price of rubber will come down to the level of the 1948 or 1949 prices, we may proceed to consider whether indigenous rubber will require any protection from the competition of imported rubber and if so what should be the proper method of affording that protection. We have estimated that the fair selling price for indigenous rubber RMA 1 FOB Cochin is Rs. 128 per 100 lbs. According to the figures furnished by the Indian Rubber Board, the average prices of rubber RMA 1 FOB Colombo was Rs. 66·52 per 100 lbs. in 1948 and Rs. 60·07 for 100 lbs. in 1949. We may take the average of these two figures, viz., Rs. 63·30 per 100 lbs. as the future price of rubber in the world market. Adding 15 per cent to the FOB price for freight, insurance, etc., the c. i. f. price would be Rs. 72·80 per 100 lbs. Allowing Rs. 1·20 for 100 pounds as the clearing charges (on the basis of figures furnished by Dunlop Rubber Co.) the landed cost comes to Rs. 74 per 100 lbs. On this basis the difference between the fair selling price for indigenous rubber and the landed cost of imported rubber would be Rs. 54 per 100 lbs. or 73 per cent of the c. i. f. price. Thus the amount of import duty required to protect indigenous rubber from the competition of imported rubber would come to 73 per cent. The above figures indicate that if and when the world price of rubber falls to a normal level which we have assumed to be the average of the prices prevalent in 1948 and 1949, indigenous rubber will require a very high degree of protection which is likely to be of the order of 70 per cent of the probable c. i. f. price. In this connection, however, we have to take account of the very frequent and wide fluctuations in the price of rubber in the world market. Thus, to take only a few instances of recent occurrence, the London spot price per lb. for No. 1 smoked sheet fluctuated between 1 sh. 4 d. and 8$\frac{3}{8}$ d. in 1947, between 1 sh. 3$\frac{1}{8}$ d. and 11 d. in 1948 and between 1 sh. 3$\frac{1}{16}$ d. and 9$\frac{1}{8}$ d. in 1949. On the basis of these figures the difference between the highest and lowest prices of rubber per 100 lbs. would amount to Rs. 43-12-0 in 1947, Rs. 27/- in 1948 and Rs. 28-8-0 in 1949. It would, therefore, follow that the rate of protective duty would have to be frequently varied according to the fluctuations in the price of rubber in the world market from week to week and from month

to month or alternatively that such a duty would have to be fixed at a very high figure so as to afford protection against the lowest possible level of world price. It may, however, be pointed out that variations of import duty from week to week or from month to month would not be feasible from the administrative point of view. Such frequent variations in the duty would also be a serious source of disturbance to trade. On the other hand, to levy a duty which should be sufficiently high to take care of the lowest possible level of price fluctuations would call for a prohibitive rate of duty which would be unfair to the consumers and excessively generous to the producers. A third alternative method that could be adopted would be to levy a duty on the basis of a fixed tariff value for imports of rubber as is done in a number of cases at present. This method, however, would also be seriously defective in that when the c. i. f. price falls appreciably below the tariff value, the importers or the consumers might import such low priced rubber on a large scale so as to meet the whole or a large part of their requirements so that the purchases of indigenous rubber would be diminished to a considerable extent. In view of these serious difficulties of affording protection to indigenous rubber by means of an import duty we consider that protection to the industry if and when such protection is called for should be afforded by means of import control instead of through import duties. However, in order that the advantage of an artificially restricted supply may not be abused by the indigenous producers of rubber by charging an unduly high price, it would be necessary to safeguard the interests of the consumers by fixing a statutory maximum price, as is intended, in fact, under section 13 of the Indian Rubber (Production and Marketing) Act 1947. Such a method of protection-cum-price control may also be advantageous to the consumers as well as the exporters of rubber manufactures because the average cost of rubber to the rubber manufacturers would be lower than what it would be if imports were subject to the levy of a duty. In this connection, it may be noted that by far the largest section of the rubber manufacturing industry is the tyre industry which is an important auxiliary to motor transport and which, besides, has developed in recent years a valuable export trade the average value of our exports of rubber manufactures, consisting mostly of tyres and tubes, being over Rs. 200 lakhs per annum during the period from 1946-47 to 1948-49. We have, therefore, arrived at the conclusion that if and when, owing to an appreciable fall in the price of rubber in the world market, indigenous rubber has to be protected, such protection should be given by means of import control which should however be coupled with the fixation of statutory prices for different grades of rubber.

21. Future competitive position of the industry

We may now proceed to discuss whether the indigenous raw rubber industry is likely within a reasonable period of time to develop sufficiently to be able to carry on without protection or State assistance. As we have indicated earlier the difference between the fair selling price for indigenous rubber and the probable future landed cost of imported

rubber on the return of normal conditions would be of the order of 70 per cent of the c. i. f. price. This is an enormous disparity between the two prices. But with the progressive materialization of the rehabilitation plan during the next sixteen years or so, for which we have provided a reasonable amount in our estimate of the fair selling price the disparity between the fair selling price of indigenous rubber and the probable future price of the article in the world market should continuously diminish. When the rehabilitation plan will have been carried through, the average yield of rubber on the estates is expected to increase from 350 lbs. per acre to 750 lbs. per acre. This by itself should bring about an appreciable reduction in the cost of production. On the assumption that there would be no significant rise in the main elements of cost, such as wages, manuring, spraying and transport, an increase in the average yield from 350 lbs. to 750 lbs. per acre should bring down the cost to about half of the present figure, that is, to about Rs. 64 per 100 lbs. We consider that when the industry will have been completely rehabilitated during a period of 15 or 16 years it should be possible for it to achieve a cost of about Rs. 64 per 100 lbs. When such a position would have been reached the industry should be able to carry on without protection or State assistance or with only a nominal amount of protection or assistance.

22. Industry's claim for de-control

As we have mentioned in the preceding paragraph, the representatives of the rubber producers have claimed that since the present protection-cum-control has resulted in an appreciable disadvantage to the rubber growers, control over the prices of rubber should be withdrawn so that they may sell their rubber at the very high prices now ruling in the world market. If this suggestion were accepted it would mean that the rubber manufacturers of the country would have to buy rubber at the world prices and thus lose the advantage of the statutory maximum prices fixed by Government. It would also however follow as a logical corollary of the proposed measure of de-control that when the world price of rubber becomes lower than the cost of production of indigenous rubber, the rubber manufacturers would be free to import foreign rubber to meet their entire requirements thus dispensing with indigenous rubber altogether or alternatively that they would be prepared to buy indigenous rubber only at the lower level of world price. We explained to the growers' representatives these implications of their demand for de-control. They however replied that they were fully alive to these implications and would be prepared to face a possible slump in prices in future. In support of the position they had taken they stated that if they were allowed to enjoy the benefit of the abnormally high price in the world market of rubber they would be able to build up strong reserves which would assist them in meeting the loss, if any, that might accrue in future owing to an appreciable fall in the price of rubber.

23. De-control not consistent with the long-term interest of the industry

We have carefully examined this claim of the industry for de-control of rubber prices. It may be granted that de-control of rubber prices would certainly enable the indigenous rubber producers to make large profits from the abnormally high prices ruling at present in the world market. But judging from the past experience of wide fluctuations in rubber prices in the world market we think that the present period of high prices is likely to be followed by a long period of low prices. As a matter of fact the factors of demand and supply have already begun to change in a manner which is likely to lead to a progressive fall in the prices of rubber in the near future. Thus according to the figures published in the Records and Statistics Supplement to the Economist, London, dated 3rd March, 1951 (Pages 157—58) the world output of natural rubber in 1950 sharply expanded by 372,500 tons to 1,860,000 tons which is the highest output ever recorded. On the other hand, the world consumption of natural rubber in 1950 totalled 1,650,000 tons which was 212,500 tons more than in 1949. It would thus be seen that, although in 1950 the world consumption had increased, there was an excess output over consumption to the extent of 210,000 tons. Besides owing to the abnormal rise in the price of natural rubber, the production and consumption of synthetic rubber have also been rapidly increasing at the present time. Thus the world consumption of synthetic rubber increased from 113,000 tons in the last quarter of the same year and the total consumption in 1950 was 575,000 tons as compared with 450,000 tons in 1949. It may also be pointed out that in March, 1950 the price of synthetic rubber in the U. S. A. was 18½ cents (U. S. A.) per lb. or Rs. 88·3375 per 100 lbs. (at Rs. 477½ per 100 U. S. A. dollars) as compared with the price of natural rubber at Rs. 85·65 per 100 lbs. f. o. b. Colombo. In December, 1950 however whereas the price of synthetic rubber in the U. S. A. was increased to 24¼ cents (U. S. A.) per lb. or Rs. 116·9875 per 100 lbs. the price of natural rubber had risen enormously to the figure of Rs. 248·38 per 100 lbs. f. o. b. Colombo. In the light of these figures we think that the price of natural rubber is likely to decline appreciably in the near future. Moreover while the present abnormally high price of natural rubber is leading to a rapid increase in production it is at the same time causing a decrease in the demand for natural rubber specially through the process of substitution of synthetic rubber for natural rubber. It is likely that until the price of natural rubber has come down considerably so as to be nearer the price of synthetic rubber the excess of production over the consumption of natural rubber will become larger thereby creating a serious potential threat to the maintenance of reasonably remunerative prices for natural rubber. In connection with the recent increase in the production of natural rubber it may be noted that of the total increase of 260,939 tons in Indonesia in 1950, 98 per cent was contributed by small holdings. Similarly in Malaya whereas the production in the estates in 1950 declined by about 24,000 tons that in the small holdings increased by 58,000 tons. From this it would be seen that by

far the greater part of the recent increase in the production of natural rubber in Indonesia and Malaya has been contributed by the small holdings. The history of rubber regulation in the past would show that whereas the large estates react quickly to a slump in prices by curtailment of production the reaction of the small holdings to a fall in price is slow and uncertain. It is therefore likely that when the present overproduction leads to a slump in the price of natural rubber such a slump may prove to be rather intractable over a period of time. Moreover if and when the present international tension eases off, not only would there be a cessation of demand for rubber for stockpiling purposes but also the stockpile of rubber would be thrown upon the world market, thereby offering a further threat to the maintenance of a fair price for rubber. The consideration of these factors leads us to think that the prices of natural rubber are likely to fall to an appreciable extent before long. Even if the prices fall no lower than the average level of 1948 and 1949 which was Rs. 63·30 for RMA—1, f. o. b. Colombo, corresponding to a c. i. f. price of Rs. 74 per 100 lbs. at Indian ports, it would still be much below our estimate of Rs. 128 per 100 lbs. as the fair selling price for indigenous rubber. Having regard to these factors, we have come to the conclusion that it would be in the interest of the indigenous rubber growers in the long run to continue the present system of protection and assistance, viz., the fixation of a schedule of statutory prices and making such prices effective through import control, if and when required.

24. Future development of the industry

We have in previous paragraphs of this Report described the rapid development of the rubber plantation industry in India during the last half century. We have been informed that about Rs. 12½ crores have been invested in this industry and that it gives employment to about 67,000 persons. The value of the produce of this industry was estimated in 1946 to be about Rs. 360 lakhs on the basis of the prices fixed by Government at that time and at the present controlled price, if we do not take into account the high world prices of rubber during the last few months, this value will be much greater. These figures would indicate the importance of the industry in the economy of the country, especially in South India where it is largely located. Besides, raw rubber has become an article of strategic importance both in war and peace time and its production and use has become a vital national necessity. Rubber is now considered as one of the wonder basic materials of the 20th century from which thousands of utility goods are now being manufactured in all parts of the world. During World War II, when Japanese occupation cut off supplies of this material from the rubber growing countries of South East Asia, the Allied Nations explored all possible sources to obtain rubber required for the defence requirements. This acute shortage of rubber during this period led to one of the greatest achievements of science, viz., the discovery and production of synthetic rubber in America to the extent of nearly one million tons, which has become in peace time the greatest threat to the future of natural rubber

while the total potential production capacity from both sources far exceeds the existing consumption capacity. We have already pointed out that a large rubber manufacturing industry has developed in the country during the last 30 years. Unlike India, Malaya, Ceylon and Indonesia produce considerable quantities of rubber but have no rubber manufacturing industries, and the U. K., the U. S. A. and the continent of Europe have rubber manufacturing industries but have no raw rubber production in their countries. The Indian rubber manufacturing industry at present requires about 21,000 tons of rubber per annum and we expect the indigenous consumption of rubber to increase to 27,630 tons per annum at the end of the next three years. The indigenous rubber manufacturing industry has become an important strategic industry. During World War II, it was able to supply the needs of the defence services when supplies of rubber manufactures were difficult to obtain from abroad due to lack of shipping facilities. We have already mentioned elsewhere in the Report that the Indian Rubber manufacturing industry has developed a large volume of export trade. We have however been informed that there is great scope for further development of the rubber manufacturing industry in the country and that the existing capacities of the producing units exceed their actual production. Against the present indigenous demand of about 21,000 tons of rubber per annum the annual production of rubber in the country ranges between 16,000 and 17,000 tons per annum. During the last 5 years, however, there has been a downward trend in the production of indigenous rubber. We have been informed that in 1950 Indian rubber production recorded a slight decline because of adverse weather conditions and the wide disparity between Indian and world prices. It is also stated that the progress of new plantations has also slowed down to some extent because the planters preferred to grow other remunerative crops. Under the present conditions there is a considerable gap between the indigenous production and demand of rubber and about 4,000 to 5,000 tons per annum have to be imported to make up the deficiency. It is, therefore, of great importance that the Indian rubber plantation industry should be developed for the production of more and cheaper rubber.

The importance of rubber to a nation can be realized from the progress of the American synthetic rubber industry and the attitude of the U. S. A. towards it. In 1939 the U. S. A. was dependent practically for all its supply of raw rubber on far-off areas in the East. These areas were lost to the Japanese early in the war. Faced with an acute shortage of rubber the U. S. A. which had only 10,000 tons synthetic capacity in 1940 very soon established a plant production capacity of about a million tons of synthetic rubber at a cost of about 700 million dollars. We have been informed that at present the production and utilization of synthetic rubber in the U. S. A. is governed by the Rubber Act, 1948. The Act provides that the capacity for the production of synthetic rubber should be maintained in the U. S. A. at all times and requires that minimum quantities shall be produced and consumed each year. Provision is also made for the continued production of synthetic rubber for its consumption in certain goods, for stand-by maintenance,

if plants are not now in operation and for continued Government research in synthetic rubber. The synthetic rubber industry in the U. S. A. is stated to be for all practical purposes a Government sponsored and protected industry and its consumption for certain goods like passenger cars is mandatory. The present position of the synthetic rubber industry is such that, apart from preventing serious world shortages, it acts also as a buffer against any price increase of natural rubber. Though natural rubber still has some advantages over the general purpose synthetic rubber in regard to cost of production and certain physical properties, the real danger will come from the special purpose rubber which though not possessing all the valuable properties of natural rubber are still admirably suited for certain uses in view of their special properties. Production of synthetic rubber is now so advanced and competitive that the U. S. A. has been estimated to consume nearly 2 lakh tons more than what is necessary under mandatory consumption. The present goal of research in synthetic rubber is to arrive at a product which is as good as natural rubber but cheaper than that. The demand for natural rubber is still good but its future prosperity is likely to depend to a large extent on how it will be able to compete with the synthetic product both in price and quality.

If plantation rubber is, therefore, to continue to compete successfully in world markets, it must concentrate on :—

(i) low cost of production which involves high yields per acre, and

(ii) quality and grading so as to be able to meet manufacturers' needs much more exactly than in the past.

The Development Committee for the Rubber Plantation Industry has formulated a scheme for the development of the Indian rubber plantation industry. It is there pointed out that " to reduce the Indian costs of production of rubber to a standard which would bear reasonable comparison with that of the major rubber producing countries in the East, economies have to be effected in the smallest items of expenditure." The Development Committee proceeds to state : " The problem of producing cheaper rubber involves raising the standard of yield and reducing the cost of production. The first on which the latter depends, can be solved only by replacing the present obsolete stands of rubber with high yielding strains of it and by applying modern scientific methods of cultivation. In spite of high costs and the long period of unproductivity, the yield from areas replanted with high yielding material should be such as to expect good profits."

" It may be argued that even after doing this we may be on the debit side to the extent of about 25 per cent in yield and that the cost of production should be higher up to a corresponding degree. To offset this, we have the benefit of indigenous labour whose wages are naturally lower than those of imported labour in countries like Malaya and Ceylon. Therefore the loss in crops may be made up by the gains in the latter."

It is further pointed out :—"Yield is a hereditary quality. The main reasons for the low standard of yield are climatic conditions, inherent low yielding capacity of the older trees and deterioration of the soil and the tree owing to lack of good husbandry and bad tapping in the small holdings which constitute about 40 per cent of the total planted acreage. In well managed estates manuring and other modern scientific methods are being applied satisfactorily but these may not increase the yields in any considerable measure. On the other hand, these methods could have produced more satisfactory crops in the small holdings had not the bark of the trees been so badly damaged by bad tapping and neglect of the trees. In the circumstances, the present standard of yield per acre of old unselected rubber cannot be increased in any appreciable degree by adopting improved scientific methods of cultivation alone. The solution of the problem lies in the replacement of the present stand of low yielding rubber trees by high yielding strains of them and the adoption of improved methods of cultivation."

The main features of the Development Plan prepared by the Development Committee are as follows :—

Replanting the existing stands of old, obsolete rubber trees by improved, high yielding planting materials which are capable of increasing the output by two to three times. As regards the rate of replanting the plan points out :

"It would not be advisable to replant all the present obsolete rubber areas within a shorter period than 15 years. It should be spread over a period of 15 to 20 years with due regard to the country's economy, financial resources, technical problems, demand for the commodity and labour problems."

"With the exception of those plantations which have already planned for replanting in 1951, the general scheme can be put into operation only in 1952. Areas have to be selected and demarked and planting companies may have to obtain the permission of their Directors. Most important of all, the necessary planting material has to be obtained and prepared for planting. Seed for producing stump plants or for budding can be obtained only during the next seeding season in 1951. And the plants will be ready for stump planting or budgrafting by 1952 planting season, at the earliest. Therefore, the proposed scheme is planned to come into operation in 1952 and the replanting of suitable areas to be completed in 16 years, i. e., in 1967."

A tentative scheme for the planting and replanting of the rubber estates has been drawn up by the Development Committee for the Rubber Plantation Industry, which will be found in *Appendix XXXV*. Under this scheme, replanting is to be carried out on 120,000 acres and new planting on 10,000 acres. The full effect of this scheme on production is expected to be realized by 1979 when the production of rubber in the country is likely to increase to about 50,000 tons per annum. The scheme also contains suggestions for (i) amalgamation of the small

units, (ii) improving the efficiency of the tappers, (iii) a more intensive system of tapping, (iv) adoption of labour saving devices for preparing raw rubber and (v) scientific research.

We believe that the proposals made under the scheme are well conceived. But we think it desirable that the details of the scheme should be fully examined. We recommend that the Indian Council of Agricultural Research should be requested to examine the scheme and report to Government as to whether any modifications in the scheme are necessary and also whether any special machinery should be set up for the implementation of the scheme.

In our estimate of the fair selling price for indigenous rubber we have provided a reasonable amount, viz., Rs. 6·82 per 100 lbs. for purposes of development-cum-rehabilitation of the industry. We have carefully considered whether this amount should be collected from the producers for the creation of a separate Development Fund to be administered by the Indian Rubber Board. We discussed the matter with the representatives of the Indian Rubber Board in the course of our inquiry and found that they were not in favour of the proposal to create a separate Development Fund. We would however suggest that the Indian Council of Agricultural Research should, while examining the development scheme, also consider the proposal for the creation of a separate Development Fund. Pending the examination of this matter by the Indian Council of Agricultural Research and the consideration of the Council's recommendations in this behalf by Government, the rubber producers should be allowed to retain the amount provided for rehabilitation and be given an opportunity to undertake rehabilitation work in their estates and holdings and set aside the amount in a special reserve for the purpose of rehabilitation. If it is found at the end of a year that the rubber growers are not utilizing the amount for rehabilitation of their estates and holdings but are frittering away the money in the payment of excessive dividends, Government should consider the question whether the fair selling price to be paid to the rubber growers should not be reduced by the amount of the rehabilitation fund instalment provided by us in our estimate of fair selling prices.

25. Research.

(a) We have been informed that the development of the rubber plantation industry in the world owes a great deal to scientists whose work on rubber has enabled the industry to develop from small beginnings into a supplier on a large scale of one of the world's most important raw materials.

(b) In most of the important rubber growing countries in the East, especially in Malaya, Indonesia, Ceylon and Indo-China there has been progressive development of systematic scientific research work on the production aspect of the industry which in some cases came into existence by the end of the first decade of this century. In these countries researches were carried out into the problems of the industry not only in Central Institutes maintained from the revenues obtained by the levy

of a cess from the rubber growers, but also by private research institutes established by some of the big rubber planting companies, such as the Dunlops.

(c) The development of scientific research in India dates from 1909 when as a result of the efforts of the rubber planters, a rubber scientific officer was appointed by the Government of Madras. The next step taken to promote research was the establishment of the Mundakayam Research Station which was maintained by the United Planters' Association of Southern India and by a grant from Government. In consequence, however, of the slump in the prices of rubber in 1932, this research station was closed down due to lack of funds for its maintenance. During its period of existence the Mundakayam Research Station did excellent work in the field of research, the most important of this being its work on mycology and the prescription by Ashplant of spraying with Bordeaux mixture for the control of Phytophthora disease. Since the closing down of the Mundakayam Research Station, there has been no further systematic research into the problems of the Indian Rubber Plantation industry with the result that the condition of the Indian rubber estates and small holdings is backward as compared to that in other countries and only a few progressive planters are in touch with the developments in other rubber producing countries.

(d) The main objective of research on rubber is the production of cheap and good quality rubber. Besides, there are in this country many planting problems to be solved. Research involves long range experiments and investigations. Further, the developments in research in other rubber growing countries require to be tried before they can be successfully adapted to the conditions of this country and in some cases the recent types of high yielding plants may not be available for commercial planting in this country and it will therefore be necessary to develop suitable types of indigenous planting material.

(e) The importance of research into the rubber plantation industry has been recognised by the Indian Rubber Board and, at its meeting on 25th November, 1949, accepted the suggestion of its Chairman that the Rubber Board should establish its own research station at some suitable place in the plantation districts.

(f) It has been stated that rubber production research has two different important aspects. One is botanical research such as the research on the rubber tree which is the work of the botanist, pathologist and soil chemist. The other aspect is research on the various processes commencing from the production of latex from the time it leaves the tree to the completion of processing into the final raw product, which aspect is the work of the rubber chemist. It has been pointed out to us that the Botanical Research Station should be located in the rubber planting district so that there may be close acquaintance with the plants that are being investigated.

(g) It has, however, been recognised that research by itself will not have any effect unless some sort of extension service is established

to disseminate scientific knowledge among rubber growers, particularly the small holders. The mere publication and distribution of journals, bulletins, pamphlets, etc., will not have the desired result of making the rubber growers take active interest in improving their plantations and methods of production. It has therefore been suggested that the present deplorable condition of the small holdings and small estates could only be effectively tackled by approaching the actual grower in person and explaining to him in his language and by demonstrations the utility of improvements that should be made on the basis of researches carried out.

(h) We have been informed by the Indian Rubber Board that there are no facilities at present for research, such as research laboratory or experimental station, for undertaking any research work. The Rubber Board has however two technical officers, namely, the Rubber Production Commissioner and a Field Officer, who are doing some technical work. The nature of technical work being done by the Board at present is stated to be as follows :—

(i) *Advisory.* Advice on the latest scientific methods of cultivation and preparation of rubber including concentration of latex by creaming and centrifuging is given by correspondence and visits whenever necessary.

(ii) *Extension Work.* With the object of disseminating scientific knowledge and the results of scientific research carried out in other countries the Rubber Board has been publishing serial pamphlets (quarterly) in English and Malayalam as well as special pamphlets on specific subjects and supplying them free of cost to rubber growers and to other institutions in exchange of their publications. These in future will appear as 'Bulletins,' 'Circulars' and 'Planting Manuals' respectively.

(iii) *Training in latex concentration, preservation and testing.* The Board has a special laboratory in which some latex testing work is being done. Short courses of training are given to estate staff on the principles of concentration and preservation of latex in addition to latex testing.

(iv) *Distribution of selected high yielding planting materials.*

A survey of locally available high yielding planting material has been made and a list of approved planting material published. With the object of encouraging the use of such material, particularly by small holders, the Board has been distributing selected germinated clonal seeds among rubber growers at a nominal price since 1949. Instructions regarding the establishment of clonal seedling nurseries are also being given. About 84 clonal seedling nurseries have now been established in the different rubber growing districts of S. India.

(i) At the public inquiry we discussed the question of research for the rubber plantation industry. There was a consensus of opinion that for a proper planned development of the Indian Rubber Plantation Industry, co-ordinated and systematic researches should be made into the various problems confronting the industry as was being done in other rubber growing countries. We, therefore, recommend that an all India Rubber Research Institution should be established for carrying out researches into the Indian rubber plantation industry on the lines discussed above, which should work in close co-operation with the Indian Rubber Board and under the guidance and supervision of the Rubber Production Commissioner.

As regards the question of obtaining the funds for the purpose, the representatives of the industry suggested the following methods either alone or in combination :—

(i) levy of a cess on the rubber plantation industry ;

(ii) contributions by the Governments of Madras and Travancore-Cochin ;

(iii) creation of a fund from the difference between the Indian controlled price and world price ;

(iv) joint contribution by the Central and State Governments concerned and the rubber plantation industry to the Indian Council of Agricultural Research for undertaking research on the lines described above.

We recommend that Government should request the Indian Council of Agricultural Research to examine the scheme and that, if it is found to be suitable, steps should be taken to implement it with the co-operation of the Governments of Madras and Travancore-Cochin, the Indian Rubber Board and the Indian Council of Agricultural Research.

SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

27. Our conclusions and recommendations are summarized as follows :—

(i) The scope of the Board's inquiry is as stated in *Paragraph 1*.

(ii) Plantations of rubber in India on a commercial scale may be said to have commenced in 1902.

Paragraph 3 (b).

(iii) The total area under rubber at the end of 1949 was 1,69,425 acres and the production of rubber in that year was 15,587 tons. In 1950, the production of rubber was only 15,599 tons and this is attributed to adverse weather conditions and the wide disparity between

internal and external prices. The progress of new planting has also slowed down to some extent as the planters preferred to grow other remunerative crops.

Paragraph 3 (b).

(iv) Travancore accounts for a very large area of 1,22,493 acres, forming 72·30 per cent of the total acreage under rubber. The remaining area under rubber is distributed in Cochin (8·13 per cent), Malabar (15·73 per cent), Mysore (0·23 per cent), and rest of India (3·61 per cent).

Paragraph 3 (c).

(v) The size of rubber plantations in India ranges from a fraction of an acre to a maximum of 3,000 acres. Rubber plantations of 100 acres and above are known as estates and those whose area is less than 100 acres each are classified as small holdings.

Paragraph 3 (e).

(vi) The distribution of estates and small holdings according to their size is given in the Table in *Paragraph 3 (e).*

(vii) There are 253 rubber estates of 100 acres and above, covering an area of 1,02,576 acres which constitutes 60·5 per cent of the total planted area. The small holdings numbering 13,610 with a total of 66,850 acres account for 39·5 per cent of the total area.

Paragraph 3 (e).

(viii) Of the total area of 1,69,427 acres under rubber in India, 1,37,902 acres, i. e , 81 per cent is planted with unselected ordinary seedling and about 19 per cent with selected high yielding planting material, viz., clonal seedling and budding. Of the percentage of the area under selected planting material, the area planted with budded plants known as clones is only approximately 14 per cent of the total acreage.

Paragraph 3 (f).

(ix) In the use of improved planting material, estates over 100 acres are far ahead of small holdings. During the period from 1925 to 1950 the area planted with such material on estates was 28,103 acres compared with only 3,422 acres in the case of small holdings even though the total area planted by the latter during this period was much higher than that by estates. The main reason for this is stated to have been the lack of knowledge among the small holders about the advantages of using better planting material.

Paragraph 3 (f).

(x) The total area under rubber in the country under the heads "mature" and "immature" is 1,19,933·07 and 49,493·39 acres respectively.

Paragraph 3 (g).

(xi) The average yield of rubber per acre in India varied from 294 to 315 pounds during the period from 1940 to 1945. In 1949 the average yield obtained per acre was only 282 pounds. The average yield of unselected ordinary seedling was only 250 pounds per acre.

There are considerable areas, especially of small holdings, which yield only 100 to 200 pounds per acre due to lack of proper cultivation of the soil and bad tapping for a number of years in the past.

Paragraph 3 (h).

(xii) The main reasons for the low standard of yield per acre in India are stated to be (i) climatic and soil conditions, (ii) lack of proper maintenance and cultivation of the soil, (iii) planting of rubber on unsuitable land, (iv) age of plants and (v) leaf diseases.

Paragraph 3 (h).

(xiii) Many progressive plantations have been replanting with improved types of rubber trees even though on a small scale, since the early thirties. The total area replanted up to the end of 1949 amounts to 11,268 acres of which only 192 acres were replanted by small holders.

Paragraph 3(i).

(xiv) The Development Committee for the Rubber Plantation Industry estimates the total area available for replanting at 1,20,000 acres.

Paragraph 3(i).

(xv) In India, only the imported older proved clones and clonal seeds are available for planting and the best of these are capable of giving yields amounting to 700 pounds per annum, although in some plantations in South Travancore yields of over 1000 pounds have been reported to have been obtained.

Paragraph 3(j).

(xvi) If the Indian rubber plantation industry is to survive and compete in a free world market, it is essential that rubber should be produced as cheaply as possible and this can be only done by the introduction of new high yielding clones.

Paragraph 3(j).

(xvii) Many of the plantations have already realized the importance of replanting and have made programmes for replanting at the annual rate of 5 to 10 per cent of the total acreage.

Paragraph 3(i).

(xviii) During the first three decades of the present century, practically all the rubber produced in the country was exported, because there was, at the time, no important rubber manufacturing industry in the country.

Paragraph 6(a).

(xix) The rubber manufacturing industry was started in India in 1920, with the establishment of a general rubber goods factory named the Dixie Aye Rubber Factory Ltd., in Calcutta. The real beginning of the industry can, however, be said to have taken place after 1930 when the International Rubber Regulation Agreement (1934) came into operation and the large overseas manufacturers of rubber goods began

to decentralise their production, some of them establishing their subsidiary factories in India.

Paragraph 6(a) & (b).

(xx) The Indian rubber manufacturing industry now consists of more than a hundred units located mostly in Calcutta, Bombay and Travancore.

Paragraph 6(c).

(xxi) The classification of the Indian rubber manufacturing industry and the production capacities of manufacturing units is given in *Paragraph 6 (d).*

(xxii) The Indian rubber manufacturing industry has expanded considerably and, in addition to meeting most of the domestic requirements, it has built up a substantial export trade with countries like Ceylon, Egypt, Strait Settlements, etc.

Paragraph 6 (e).

(xxiii) During the period 1946-1949 India was able, after meeting domestic requirements, to export rubber goods to the value of Rs. 186 lakhs per annum on an average.

Paragraph 6 (e).

(xxiv) The total world production of rubber in 1949 was 14,87,500 tons which comprised 14,15,000 tons from South East Asia and 72,500 tons from other parts of the world. The world production of rubber in 1950 has been estimated to have reached a peak of 18·60 lakh tons as compared to the production of less than 15 lakh tons in 1949 and the previous record of 16 lakh tons in 1941.

Paragraph 7 (a) (i).

(xxv) The Indian controlled prices have been appreciably above the world prices during the last two and a half years, the difference at times being as big as Rs. 39 per 100 lbs. It is, however, only from April 1950 that the world prices of rubber have risen much above the Indian price and have fluctuated around Rs. 300 per 100 lbs. during the last few months, the price in Feb. 1951 being Rs. 320 per 100 lbs. This rise in price is reported to be due to stockpiling programme in the U. S. A. and heavy purchases in Malaya by the U. S. S. R.

Paragraph 7 (a) (iii).

(xxvi) The production of rubber in India was 15,587 tons in 1949 which represents an insignificant percentage of the total world production.

Paragraph 7 (c).

(xxvii) The largest consumer of rubber is the U. S. A. whose consumption in 1949 was 5,74,522 tons.

Paragraph 7 (d).

(xxviii) Statements regarding the rubber reclaiming capacity and the production and consumption of reclaimed rubber in different coun-

tries as well as of production and consumption of synthetic rubber is given in *Appendices XXIV* to *XXIX*.

Paragraph 7 (e).

(xxix) During the period from April 1942 to September 1946, the production and prices of rubber in India were controlled under the Indian Rubber Control Order, 1942 and subsequently by the Indian Rubber Control and Production Order, 1942.

Paragraph 8.

(xxx) Since April 1947 the production, consumption and prices of rubber in India have been controlled under the Rubber (Production and Marketing) Act, 1947, whose main provisions are given in *Paragraph 8*.

(xxxi) Since 23rd November, 1950, the maintenance of stocks and disposal of raw rubber by any person has been subject to statutory control under the supervision of Rubber Production Commissioner who has been appointed as Rubber Controller since January, 1951.

Paragraph 8.

(xxxii) Government announced on 7th March, 1951 a revised price of Rs. 122-8-0 per 100 lbs. f. o. b. Cochin, with suitable differentials for other grades, pending the recommendations of the Tariff Board.

Paragraph 8.

(xxxiii) The consumption of rubber has varied considerably during the last 15 years. In 1938, the internal consumption reached the figure of 5,600 tons and it went on increasing steadily till it reached 14,292 tons in 1941. From 1942 to the end of the war, there was great demand for more and more production of rubber in India in view of the increased requirements of the Allies for their programme of war production. During 1945 the consumption of rubber was 15,233 tons and in 1948 it was over 19,000 tons.

Paragraph 9.

(xxxiv) India has by now developed within her borders a rubber manufacturing industry whose requirements of raw rubber exceed indigenous production.

Paragraph 9.

(xxxv) Rubber is consumed by about 250 manufacturing units in this country and of these the three principal consumers are Dunlop Rubber Co. (India), Ltd., Firestone Tyre & Rubber Co. of India Ltd., and Bata Shoe Co. Ltd.

Paragraph 9.

(xxxvi) Out of the average total consumption of rubber of 18,882 tons for the years 1948, 1949 and 1950, Dunlops account for 45 per cent, Firestones for 21 per cent and Batas for 10 per cent. Thus, these firms together account for average consumption of 14,283 tons per annum or about 76 per cent of the total consumption. The remaining

24 per cent is distributed among a large number of rubber goods manufacturers.

Paragraph 9.

(xxxvii) The various factories have big expansion programmes for increasing production and for manufacturing new items.

Paragraph 9.

(xxxviii) The total demand for raw rubber is estimated to be 23,500 tons in 1951, 25,300 tons in 1952, and 27,630 tons in 1953.

Paragraph 9.

(xxxix) Out of the total annual production of rubber in the country 72·30 per cent is contributed by estates. Though the holdings account for 39·5 per cent of the total area under rubber, their production is proportionately much less and is only 27·70 per cent which is attributed to the lower yields obtained.

Paragraph 10 (b)

(xL) The main reasons for the recent fall in production are (i) fall in yields of old plantations, and (ii) suspension of tapping.

Paragraph 10 (c)

(xLi) Rubber is produced almost throughout the year though its production is not equally distributed over all the months.

Paragraph 10 (d)

(xLii) The groupwise classification and grading of indigenous rubber are given in *Paragraph 10 (e)*.

(xLiii) The groupwise production of rubber is given in *Paragraph 10 (f)*.

(xLiv) The quality of the indigenous rubber is as good as that of the rubber produced in other countries and the indigenous producers conformed to the international system of grading.

Paragraph 11 (b).

(xLv) There is further scope for improvement in the quality of the indigenous rubber. The Indian rubber plantation industry should, therefore, make necessary efforts to make such improvements.

Paragraph 11 (b).

(xLvi) Under the Rubber (Production & Marketing) Act, 1947, licences for import of rubber are issued by the Government of India in consultation with the Indian Rubber Board.

Paragraph 12 (b).

(xLvii) Licences for export of raw rubber are allowed by Government after reference to the Indian Rubber Board.

Paragraph 13 (b).

(xLviii) The c. i. f. price of raw rubber R.M.A. 1, from Singapore in January 1951 ranged from Rs. 293-12-0 to Rs. 312-8-0 per 100 lbs.

Paragraph 14.

(xLix) The fair price for raw rubber f. o. b. Cochin will be made up of the items mentioned in *Paragraph 15 (2)*.

(L) We have adopted an average yield of 350 lbs. per acre for purposes of distributing certain overheads such as interest, return on fixed capital, etc.

Paragraph 15(7).

(Li) The provision for extras in arriving at the cost of production for 1951 are discussed in *Paragraph 15 (10)*.

(Lii) We have allowed a rate of 5 per cent interest on working capital.

Paragraph 15(11).

(Liii) The depreciation or Rehabilitation Fund, estimates of the fixed capital employed in the industry, return on capital and provision for sales tax are discussed in *Paragraph 15 (12), (13), (14) and (15)*.

(Liv) The price for No. 1 grade rubber works out to Rs. 128 for 1951 as against the existing price of Rs. 90·5 per 100 lbs.

Paragraph 15.

(Lv) The schedule of prices for all grades of rubber is given in *Paragraph 16*.

(Lvi) The policy of import control, together with fixation of statutory prices, had enabled the rubber producers to realise prices substantially above the world prices of rubber until March 1950.

Paragraph 17.

(Lvii) Since April 1950 however owing to an abnormal increase in demand for purposes of stockpiling and rearmament in the U. S. A. and other countries, the world price of rubber has been rapidly going up, the margin in favour of the world price as against the Indian price being as high as Rs. 214·88 per 100 lbs, in November 1950.

Paragraph 17.

(Lviii) It is not improbable that the world price of rubber may continue to be higher than the estimated fair selling price for indigenous rubber for a few months more. For this period, therefore, the question of protecting the indigenous rubber from the competition of foreign rubber by levying an import duty or by restricting imports of rubber, is not likely to arise.

Paragraph 19.

(Lix) If and when owing to an appreciable fall in the price of rubber in the world market, indigenous rubber has to be protected, such protection should be given by means of import control which should, however be coupled with the fixation of statutory prices for different grades of rubber.

Paragraph 20.

(Lx) When the industry will have been completely rehabilitated during a period of 15 to 16 years it should be possible for it to achieve a

cost of about Rs. 60 per 100 lbs. When such a position would have been reached the industry should be able to carry on without protection or State assistance or with only a nominal amount of protection or assistance.

Paragraph 21.

(LXI) It would be in the interest of the indigenous rubber growers in the long run to continue the present system of protection and assistance viz., the fixation of a schedule of statutory prices and making such prices effective through import control if and when required.

Paragraph 23.

(LXII) The proposals made under the development scheme drawn up by the Development Committee for the Rubber Plantation Industry are well conceived. It is desirable however that the details of the scheme should be fully examined. The Indian Council of Agricultural Research should be requested to examine the scheme and report to Government as to whether any modifications in the scheme are necessary and also whether any special machinery should be set up for the implementation of the scheme.

Paragraph 24.

(LXIII) The representatives of the Indian Rubber Board were not in favour of the proposal to create a separate Development Fund for purposes of development-cum-rehabilitation of the industry.

Paragraph 24.

(LXIV) We would, however, suggest that the Indian Council of Agricultural Research should, while examining the development scheme, also consider the proposal for the creation of a separate development fund. Pending the examination of this matter by the Indian Council of Agricultural Research and the consideration of the Council's recommendations in this behalf by Government, the rubber producers should be allowed to retain the amount provided for rehabilitation and be given an opportunity to undertake rehabilitation work in their estates and holdings and set aside the reserve for the purpose of rehabilitation.

Paragraph 24.

(LXV) If it is found at the end of a year that the rubber growers are not utilising the amount for rehabilitation of their estates and holdings but are frittering away with the money in the payment of excessive dividends, Government should consider the question whether the fair selling price to be paid to the rubber growers should not be reduced by the amount of the rehabilitation fund instalment provided by us in our estimate of fair selling price.

Paragraph 24.

(LXVI) There are no facilities at present for research, such as research laboratory or experimental station. The Rubber Board has however, two technical officers, namely, the Rubber Production Commissioner and a Field Officer, who are doing some technical work.

Paragraph 25(h).

(LXVII) The nature of the technical work being done by the Board at present is described in *paragraph 25(h)*.

(Lxviii) An All-India Rubber Research Institution should be established which should work in close co-operation with the Indian Rubber Board and under the guidance and supervision of the Rubber Production Commissioner.

Paragraph 25(i).

(Lxix) The estimate of expenditure for the proposed research institution is shown in *paragraph 25(i).*

(Lxx) We recommend that Government should request the Indian Council of Agricultural Research to examine the scheme for research recommended in paragraph 25(i) and that, if it is found suitable, steps should be taken to implement it, with the co-operation of the Governments of Madras and Travancore-Cochin, the Indian Rubber Board and the Indian Council of Agricultural Research.

Paragraph 25(i).

(Lxxi) The main features of the existing marketing systems are (i) sale of rubber by managing agency firms, (ii) sale direct to manufacturers or dealers and (iii) sale through dealers and petty merchants in the interior markets.

Paragraph 26(a).

(Lxxii) The difficulties in the marketing of rubber under the existing system are (1) difficulties in disposal of stocks, (ii) difficulties in getting controlled price, (iii) absence of fair grading and (iv) irregularity in sales of certain grades.

Paragraph 26(b).

(Lxxiii) Shri D. V. Reddy, in his Report on Marketing Organisation for Rubber, has made a number of proposals for remedying the shortcomings in the marketing of rubber. The Rubber Board should examine the proposals and take suitable steps to improve the marketing organization for rubber at an early date, in the light of the findings and recommendations of Shri Reddy. *Paragraph 26 (c).*

RUBBER STATISTICS

Monthly production of raw rubber (tons) 1948-51

Months	1948	1949	1950	1951
January	1425	1326	1291	1307
February	270	257	208	260
March	956	798	988	902
April	1498	1563	1640	1664
May	1646	1240	1450	1808
June	694	854	836	562
July	844	904	758	1258
August	1068	1245	1053	1654
September	1646	1410	1414	1756
October	1796	1944	1937	
November	1742	2011	1975	
December	1837	2035	2049	
Total:—	15422	15587	15599	

Monthly consumption of raw rubber (indigenous and imported) by rubber goods manufacturers (tons) 1948-51

Months	1948	1949	1950	1951
January	1587	1548	1162	1868
February	1494	1414	1295	1894
March	1587	1284	1320	1821
April	1668	1981	1435	2134
May	1432	1847	1372	1576
June	1875	1770	1517	1131
July	1801	1785	1800	2077
August	1902	1819	1670	2007
September	1753	1638	1506	1953
October	1109	1068	1253	
November	1700	1697	1737	
December	1811	1341	1668	
Total :—	19719	19192	17735	

World production of raw rubber (tons) 1948-1950

Countries	1948	1949	1950
Malaya	698189	671503	694086
Indonesia	432349	431841	687479
Ceylon	95000	89500	113500
Vietnam and Cambodia	43935	43010	48482
India	15422	15587	15599
Sarawak	39680	39461	55615
Other Asia	127500	125000	150000
Africa	42000	45000	55000
Brazil	20158	21318	19915
Others	10452	6859	9809
Total :—	1524685	1489079	1849485

Imports of Raw Rubber duriug 1948-51 (Tons)

Months	1948	1949	1950	1951
January	..	501	339	945
February	...	254	41	1377
March	...	954	44	1124
April	...	691	...	850
May	...	9	132	521
June	315	71	44	477
July	705	...	...	843
August	444	...	...	115
September	941	3	...	185
October	649	2	75	
November	595	66	175	
December	684	116	232	
Total	4333	2767	1082	

Production, Consumption and Stocks of Rubber July-Sept. '51 (Tons)

Groups	Production (July to Sept. '51)	Consumption by manufacturers (July to Sept. '51)	Stocks with Estates & Dealers as on 30-9-'51	Stocks in transit sold to manufacturers as on 30-9-'51	Stock with manufacturers as on 30-9-'51
Group 1	1809	2039	934	810	892
Group 2	813	1943	419	297	516
Group 3	370	479	200	71	144
Group 4	288	217	166	33	163
Group 5	239	649	270	165	350
Group 6	158	149	186	69	89
Group 7	8	14	40	2	40
Scrap Grades	486	58	593	...	66
Latex (DRC)	279	183	365	1	146
Sole Crepe	218	41	157	...	37
Estimated unspecified		*265			*150
Total	4668	6037	3330	1448	2593

*Estimated consumption and stock with some manufacturers from whom returns have not been received.

Note :—The excess consumption of rubber over production has been met out of opening stocks and imports.

Rubber Prices in Ceylon and India

GRADES	Average monthly F. O. B. Colombo prices for 100 lbs. (1951)			Controlled Indian Minimum F.O.B. Cochin price for 100 lbs.
	July	August	Sept.	From 21-5-1951
	Rs.	Rs.	Rs.	Rs.
RMA 1	227·38	227·85	239·56	127·00
RMA 2	220·63	220·55	232·38	125·50
RMA 3	210·56	211·25	224·38	124·00
RMA 4	191·19	183·75	198·00	120·50
RMA 5	169·69	157·75	166·75	116·50
Pale Latex Cr. IX	264·25	262·90	254·88	130·50
,, I	260·06	256·25	250·38	128·50
Flat Bark	135·81	129·95	130·50	91·50

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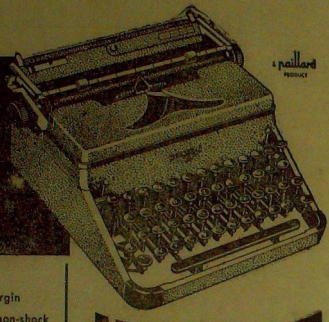

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THE INDIAN RUBBER BOARD BULLETIN

Vol. I | OCTOBER—DECEMBER 1951 | No. 4

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THE INDIAN RUBBER BOARD BULLETIN

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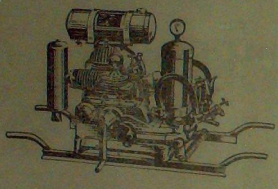

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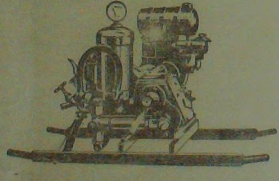

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PINK DISEASE

*Circular No. 33, Rubber Research Institute of Malaya**

Pink disease is a disease of the stem and branches caused by a fungus, *Corticium salmonicolor*. It is primarily a disease of the bark, though in advanced stages the infection may spread from the bark into the underlying wood. It can attack not only rubber but a number of other cultivated plants such as cacao, coffee, tea, ramie, and certain leguminous cover crops.

Symptoms.

The characteristic symptom of Pink Disease, and the one from which it derives its name, is the appearance upon the surface of the bark of a salmon-pink incrustation produced by the growth of the fungus. However, to those who are not familiar with the disease, or who are not specifically looking for it, it is more likely to attract attention by one or other of its subsidiary symptoms. These are :—

(i) Wilting and subsequent death of the leaves, which turn brown and remain attached to the infected branch for some time.

(ii) Bleeding of the branches or stem with the formation of black streaks of coagulated latex.

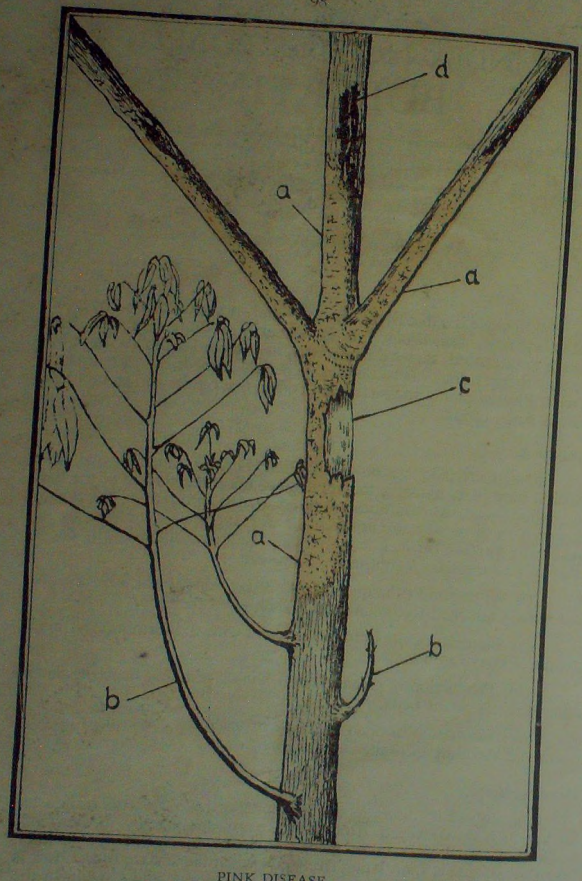
(iii) Production of green, lateral shoots resulting from the development of dormant buds.

(iv) Formation of open wounds or cankers consequent on the death and shedding of limited areas of bark.

Dissemination.

Pink disease is disseminated by spores or by fragments of infected bark, which are conveyed from one tree to another by air currents. Spread of the disease takes place principally during the wet weather, when the fungus is sporulating freely and when the surface of the bark is moist enough to favour germination of the spores and growth of the fungal threads.

*Reproduced by kind permission.



PINK DISEASE

(a) Incrustation of the fungus
(b) Lateral shoots arising from dormant buds
(c) Open wound formed by shedding of dead bark
(d) Streaks of coagulated latex

Course of the disease.

As a rule infection starts in the fork of a branch, and from this situation the fungus grows out slowly in all directions forming a pink skin or incrustation over the surface of the bark. At the same time as this superficial growth is proceeding, the fungus is permeating the bark (which it eventually kills) and penetrating into the wood. The general effect of these activities is to impede the passage of water, with the result that the leaves wilt and die and the whole extent of the branch above the point of infection ultimately succumbs. It is whilst the disease is progressing in this manner that the dormant buds beneath the infected zone are stimulated to shoot.

During dry weather the growth of the fungus may cease and the incrustation tend to lose its pink colour and become a dingy white, thus making detection of the parasite rather difficult ; though the presence of the disease can usually still be recognised by the occurrence of its subsidiary symptoms.

TREATMENT AND CONTROL

In young rubber.

In the early stages of an attack, Pink Disease on young trees may be checked by spraying or painting the infected bark with Bordeaux mixture ; or by painting it with Fylomac 90 or one of the water-miscible tar-acid fungicides listed on Page 101. The latter fungicides cannot be applied with a sprayer since they are liable to cause injury to the foliage.

When the disease has advanced to the stage where so much injury has been incurred that the leaves are beginning to wither, it then becomes necessary to cut away the diseased portion of the branch or stem and burn it. Before this pruning is carried out, however, the infected bark should be painted either with tar or with the asphalt kerosene mixture whose preparation is described on page 101. This is an important precaution which should on no account be omitted, since its object is to prevent the spores of the fungus and bits of infected bark being shaken loose and distributed by the pruning operation. Preferably all such pruning should be confined to the dry weather, as during the rainy season the disease becomes more highly infectious for the reasons already stated. However, if this rule is followed, it must be clearly understood that it is only the pruning that is delayed, the protective painting being carried out as soon as the need for it becomes apparent.

When the outbreak has occurred in a stand of young rubber it would be advisable to reinforce these merely curative measures by undertaking a course of prophylactic treatment. This would consist in spraying the stems and branches of all the trees with Bordeaux mixture at about 3-weekly intervals until the disease clears up. Particular care should be taken to spray the forks, for, as already pointed out, it is in this situation that the infection usually begins. In the absence of a sprayer, the fungicide may be applied to the forks and to the neighbouring bark by means of a brush.

As Pink Disease thrives best under conditions of high humidity, any tall undergrowth that may be present in the affected area should be cut back so as to permit free movement of the air.

In mature rubber.

For the treatment of Pink Disease in mature rubber the above recommendations need modification. To start with, if the trees are in tapping the use of Bordeaux mixture, or of any copper containing fungicide, is to be avoided owing to the deleterious effect of even minute traces of copper on the latex; or, rather, on the rubber prepared from it.

Secondly, the water-miscible tar-acid fungicides are not recommended for use on mature trees since with their thicker bark it is possible to employ preparations which are more effective, but which could not be applied to young trees without some risk of injury. If, therefore, the infection is recent and there appears to be a chance of saving the branch, it should be painted either with Cargilineum Mixture* or with the asphalt-kerosene mixture. If, however, the disease is so far advanced that it is clearly necessary to prune off the branch there is no need to use these more expensive mixtures, and an application of coal-tar would suffice.

Finally, a course of prophylactic treatment in a stand of mature rubber can hardly be regarded as a practicable proposition because of the difficulty of spraying tall trees, and because of the cost of the operation.

NOTES ON FUNGICIDES

Preparation of Bordeaux Mixture.

Bordeaux fungicides are prepared by mixing together a solution of copper sulphate and a suspension of lime. The composition, which is varied according to the crop to be treated and the disease to be controlled, is customarily expressed by three numbers—the weight of copper sulphate (in pounds), the weight of quicklime (in pounds) and the volume of water (in gallons). The directions below are for a 4 : 5 : 40 formula.

Precautions. The best results with Bordeaux mixture are obtained only if care is taken in its preparation. The following notes are important.

1. The copper sulphate must be completely in solution before the lime is added. It should be dissolved in a wooden, earthenware or copper container, as iron and galvanised iron rapidly decompose the mixture.

2. The lime used must not have deteriorated, as it rapidly does on exposure to the air. Its good condition is best assured by using freshly burnt quicklime. If slaked lime is used, the weight taken must be one and a half times the weight of quicklime.

3. The liquid should be stirred well while mixing proceeds, and it is desirable to agitate the mixture during spraying.

4. The mixture should be made immediately prior to use.

Directions. Dissolve 4 lbs. of copper sulphate in 36 gallons of water. If the crystals are large, they may be tied loosely in a bag suspended just below the water surface and left overnight. They will dissolve more quickly in hot water. If the chemical is in powdered form, it will dissolve easily if washed through a sieve into the container.

Slake 5 lbs. of quicklime in a kerosene tin, and add successive small quantities of water until it crumbles to powder. Add more water to make a milky suspension, and finally make up to 4 gallons.

Slowly pour the lime suspension through a fine mesh sieve into the copper sulphate solution,* stirring all the while with a wooden paddle.

Stock Solution. Stock solutions containing one pound in one gallon can be prepared for both ingredients, but they should not be kept too long and must be well covered. For use, appropriate quantities should be diluted and the above mixing procedure followed.

Water-miscible Tar-acid Fungicides

	Recommended concentration in water	*Agents*
Killgerm	10%	Mc Alister & Co., Ltd.
Paragerm	7½%	Lindeteves (Malaya) Ltd.
Izal	5%	Guthrie & Co., Ltd.
Black Cyllin	10%	Sandilands Buttery & Co., Ltd.
Ialine White Disinfectant	10%	Harrisons & Crosfield (Malaya) Ltd.
Ialine	10%	do.
White Septol	10%	George Blunn & Co., Ltd.
Brunolinum Plantarium	15%	James Warren & Co., Ltd.
Agrisol	25%	Sime, Darby & Co., Ltd.

Preparation of Asphalt-kerosene Mixture

Ingredients.	Asphalt e. g. Mexphalte 20/30	40 lb.
	Kerosene or Diesoline	4 gallons
	Solignum	3 pints

(Mexphalte 20/30 is supplied by James Warren & Co., Ltd.)

Method. Melt the asphalt slowly by the application of just sufficient heat to cause it to liquefy completely. Then pour in the kerosene or Diesoline with constant stirring. When this mixture has cooled, stir in the Solignum. Other wood preservatives, such as Noxo or Brunolinum, may be used instead of Solignum.

Warning. On no account should the mixture be applied while hot. If it becomes too stiff for easy application, it must be thinned down by the addition of more kerosene or Diesoline.

Pathological Division,
The Rubber Research Institute of Malaya,
Kuala Lumpur,
September, 1951.

* The practise in S. India, based on Ashplant's recommendations, is to add strong copper sulphate solution to fully diluted milk of lime. By this, it is claimed, a finer and more lasting suspension is obtained—*Ed.*

NOTES AND NEWS

Election to the House of the People.

Mr. A. V. Thomas, the Chairman of this Board, has been elected to the House of the People, from the Srivaikundam (Tinnevelly) constituency.

Review of the Work of the Indian Rubber Board

At the eleventh meeting of the Indian Rubber Board held at Bangalore, on the 21st and 22nd November, 1951, the Chairman, Sri. A. V. Thomas, reviewing the work of the Board during the year, said :—

" .....the Board is doing whatever is possible for the benefit of the rubber plantation industry with the available facilities. I may mention to you briefly the main items of work done during the year :—

(1) Collection of high yielding clonal rubber seeds.

(2) Distribution of selected clonal seeds among various growers, partly at a concessional rate and partly at actual cost.

(3) Establishment of two nurseries, one in Malabar, and the other in the Travancore-Cochin State.

(4) Giving instructions regarding :—

(a) method of germinating rubber seeds ;

(b) establishment of clonal seedling nurseries ;

(c) principles of concentration and preservation of latex ;

(d) latex testing at the Board's Chemical laboratory.

(5) Experiments to test the effect of an yield stimulant on rubber,

(6) Experiment to test the efficacy of a new fungicide for combating *oidium* leaf disease.

In addition to these items I may also mention about the issue of the Board's various publications including the Bulletins and the considerable volume of advisory work done by correspondence and personal visits wherever necessary. The Board has also been assisting the rubber growers in securing their requirements of various chemicals, iron and steel materials, etc. as far as possible. With all these it may not be possible to show any appreciable results unless the Board is enabled to proceed with a well-planned Development Scheme. I, therefore, hope that the Government of India will take all necessary steps and help us to implement the Development Scheme.....".

Supplies of Technically Classified Natural Rubber.

At its recent meeting in Holland, the International Rubber Research Board reviewed the progress made during 1951, in supplying Technically Classified Natural Rubber from the Far East.

Although the present World output of T. C. Rubber is of the order of 20,000 tons per annum, the material is at present available only in the R. M. A. grades RSS IX, 1 and 2. The Board realise that consumers

of Natural Rubber cannot take full advantage of this new and important development unless it can also be offered in the other main R. M. A. grades. The Board therefore recorded the following resolution. "The I. R. R. B., being aware of the increasing interest in Technically Classified Natural Rubber among consumers, welcome the steady progress in evolving and developing T. C. Rubber during 1951. They wish, however, to point out that the ultimate success of the scheme depends on including most of the R. M. A. grades, and on substantially increasing the supplies on the World Market. It is realized that this expansion will require appreciable expenditure by producers on test stations, and some improvement in the present arrangements for obtaining a uniform product, such as blending of field latex prior to coagulation and of solid rubber during the packing of bales, or during the remilling process, will be indispensable."

Copper Sulphate Industry—Tariff Board's recommendation

The Government of India had asked the Indian Tariff Board to investigate the claims of the Copper Sulphate manufacturing industry for protection or assistance. The Tariff Board has completed its enquiries and submitted its report. The following are its recommendations :—

1. The fair selling price of indigenous Copper Sulphate is lower than the landed cost, without duty of the imported Copper Sulphate. The industry does not therefore need protection by way of customs duty at present.

2. Should the prices of imported Copper Sulphate fall so low as to hamper the development of the domestic industry, the latter may renew its application for protection or assistance and the whole question should then be considered afresh.

3. Exports of Copper Oxide should be regulated so as to ensure adequate supplies to the local need of Copper Sulphate and other industries which can use this material to supplement the limited resources of scrap copper.

4. The concession granted by Government to agricultural uses of imported Copper Sulphate by way of refund of customs duty paid thereon, does not at present affect the demand for indigenous Copper Sulphate.

The Government of India has accepted the above recommendations.

Brazil Readies Planting Program.

Brazil's ministries of Finance and Agriculture, with the Amazonia Credit Bank, have worked out plans for a new rubber plantation undertaking. The plans call for a capitalization of about 48,000,000 cruzeiros (about $ 2,600,000) of which half would be supplied by Brazil's rubber goods industry and the rest by the Amazonia Credit Bank and by rubber growers. Plantations would be started at the same time in the states of Para and Amazonas, especially in the area round the Guama River and Fonte Boa on the Purus River. Technical assistance would be supplied

by the Northern Farm Institute (Institute Agronomico do Norte). The program envisages setting out around a million and a half to two million rubber trees. The project would be sort of a 'pilot plantation' aimed at getting other rubber growers to follow suit as private planters. "*Rubber Age: September 1951.*"

Rubber Planting in the Western Hemisphere.

Plantation rubber can be grown successfully and economically in the Western Hemisphere, according to Mr. P. W. Litchfield, Chairman of the Goodyear Tyre & Rubber Company.

The importance of Goodyear's experiments in Costa Rica, said Mr. Litchfield, was that the U. S., by intelligent planning could lessen 'the ominous perennial peril of being cut off from its source of natural rubber supply.'

Mr. Litchfield declared that 15 years of cultivation on 2,500 acres in Costa Rica owned by Goodyear had demonstrated that natural rubber of the plantation variety could be produced there at sufficiently low cost to compete with output from the Far East.

Goodyear technicians and U. S. Department of Agriculture experts had overcome the serious leaf blight that hitherto affected the native para rubber tree when cultivated in plantation form in Central and South America.

Mr. Litchfield suggested that 300,000 of new rubber plantings, which ultimately would yield 150,000 tons of natural rubber annually, be developed in the zone stretching from Southern Mexico to Brazil and Bolivia. This would represent about 12 per cent of all rubber consumed by Americans in 1951."

(*Reuter—Quoted by Rubber Digest—January 1952*).

U. S. Steps to Augment Rubber Supply.

Washington, Feb. 20, (1952). The Agriculture Department reported today another step forward in the production of natural rubber in the Western Hemisphere.

Joint rubber research under the Point Four programme is going on in 11 Latin American countries, including some 35,000 acres of a new hybrid rubber trees. The aim of the programme is to establish rubber production on a stable basis, which will provide Latin American countries with a new and profitable crop and assure the United States of a nearby source of natural rubber.

Most of the world's natural rubber now comes from the troubled areas of South-East Asia, especially Malaya. The Agriculture Department said recent demonstrations on the "three component" hevea rubber tree in Costa Rica show that it can now be transplanted with more than 85 per cent success even in dry weather. Formerly, more than half the costly plants were lost even when planted in favourable weather. UPA.

(*U. P. A. in the Hindu dated 28-2-1952*).

SUPPLY OF CLONAL SEED

To encourage the use of improved rubber planting material, particularly by small holders of rubber, for new planting and replanting, the Indian Rubber Board has been obtaining selected approved clonal seed from local sources and supplying them to rubber growers (at a reduced price) since 1949. The details of the scheme undertaken in 1950 have been described in the Indian Rubber Board Bulletin—Vol. 1, No. 1—page 14.

Whereas the quantity of seed supplied by the Board in 1949 and 1950 was about 8,000 and 160,000 respectively, in 1951 applications were received by the Board for the supply of over 5 lakhs of seed. Preliminary enquiries at the usual sources from which supplies were obtained before, indicated that owing to the storms which followed the out break of the monsoon many green pods had been blown down, and therefore, the prospects of obtaining a large crop of seed was slim. Therefore, new sources of supplies were also sought. Finally, however, sufficient quantities of seed were obtained not only for meeting the above demand of rubber growers but also for planting two nurseries established by the Board.

As the Board had no facilities to germinate such a large quantity of seed, it was decided to supply it in the ungerminated condition. A collection and despatching station was organised at Marthandom which town was found to be the most convenient centre for the purpose in South Travancore. Seeds were packed as usual with powdered charcoal in gunny bags of suitable sizes and those destined for parties in the Southern district were despatched direct from this station. Other packages to parties further north were despatched by lorry transport to the office of the Indian Rubber Board and the parties concerned were advised direct to collect the seed from there. The Scheme on the whole worked out quite satisfactorily. A quantity of seed which could not be despatched quickly as above was germinated at the grounds of the Board as in 1950 and supplied as germinated seed.

The maximum quantity of seed supplied at a reduced price of Rs. 20/- per thousand was 2,500 for any one party. Additional quantities, generally upto a limit of 2,500, were also supplied to some parties at the cost of Rs. 30/- including packing and transport charges. The total quantity of seed supplied by the Board during 1951 amounted to about 5½ lakhs. Most of the parties who obtained seeds expressed their intention of planting them in nurseries.

The Board at its eleventh meeting held on 21st and 22nd November 1951, placed on record its appreciation of the kind co-operation extended by the various estates in making the scheme a success by collecting available seed and supplying them at a comparatively low price to the Board.

The great increase in demand for supplies of approved clonal seed hrough the Board particularly from small holders is a clear indication

of the growing interest taken by them in the use of improved planting material. It also indicates that the extension work of the Board in this direction has borne good results. Not only small holders but also many estates are now seeking the advice and assistance of the Board in the matter of selection of planting material for new planting and replanting.

To maintain and further develop this interest shown particularly by small holders the Board has decided to continue the scheme of supply of approved clonal seed. For 1952, the maximum quantity of seed to be supplied to any one party at a special reduced rate has been fixed at 2,000 seeds. Limited additional quantities may be supplied at actual cost if sufficient seeds are available in the country after making the above basic allocation. Those who require much larger supplies are therefore requested to book them direct with seed suppliers in order to ensure supplies. Training in the selection of particular clonal seeds by seed characters and necessary advice for laying down germinating beds etc., can be obtained from this Board. A list of approved clonal seed suppliers may also be obtained from the Board's office on application. Other details such as price etc., will be announced in due course.

Those who desire to obtain selected rubber seeds from this Board under the above mentioned scheme should send their applications so as to reach this Board before the 30th April, 1952.

If the seed is required for replanting, the register number assigned by this Board to the holding or estate should be mentioned in the application. If it is for new planting, the locality and the survey number of the land earmarked for planting should be mentioned.

INDIAN RUBBER BOARD NURSERIES

During the seeding season in 1951 two clonal seedling nurseries were established by the Indian Rubber Board, one at Poonoor estate in the district of Malabar and the other at Rajagiri estate in Quilon district. They are being maintained by the Board under the supervision of the Superintendents of these estates.

Each nursery covers an area of about 3½ acres and the sites were kindly offered to the Board on lease at a nominal rent by the Managing Agents of these estates—Messrs. A. V. Thomas & Co., Limited. The site selected at Poonoor estate is somewhat ideal for the nursery, but that selected at Rajagiri estate consists partly of ideal land and the rest of sloping hillside which is usually considered to be unsuitable for the purpose. This latter site is somewhat typical of land available for nursery sites on many estates in this district and elsewhere. This site was, therefore, selected in order to find out whether and how such land could be made suitable for rubber nurseries. It is hoped that useful information in this regard may be obtained from this experiment.

As the seeding season was rather late during 1951, especially in South Travancore, planting of the nurseries could be completed only towards the end of September. The total number of seedlings planted in the 2 nurseries was about 1·6 lakhs. They consist of families of Tj. 1 Clone of different origin as well as of mixed clonal seedlings from a poly-clone planting.

The original object of the Board in establishing these nurseries was to supply the plants as clonal seedling stumps or budded stumps at a cheap price particularly to small holders, in order to encourage the use of high yielding planting material for new planting and replanting. But the use of such material has already gained wide popularity among the small holders through the distribution of approved clonal seed undertaken by the Board during 1949, 1950 and 1951. Most of the small holders who obtained the seed supplied by the Board, have established their own nurseries in accordance with the advice of the Board. Besides, the Board proposes to continue the scheme of supplying seed in 1952 also. Many small holders who have planned for planting after one or two years may find it cheaper to buy such seed and establish their own nurseries. Taking all these into consideration the Board has now decided to modify the original object. Accordingly, the nurseries will also be used for producing budwood and budded stumps of proved and promising clones, imported as well as locally selected. Different families of clonal seedlings are also to be grown in these nurseries. When the materials are ready, it is proposed to use them for experimental planting to test their performance, in estates and small holdings in different planting districts and under different soil and climatic conditions. The valuable co-operation of Managing Agents and Proprietors of estates and small holdings are sought in this respect.

A large proportion of the clonal seedlings from the two nurseries may still become available for supply to rubber growers. But, as planting, as stated above, was completed late in 1951, the seedlings will have completed only less than 9 months' growth by the time the next planting season in 1952 sets in. Even though the rate of growth of the seedlings had been very satisfactory earlier, it has recently begun to retard owing to drought conditions. Therefore, in spite of watering, the seedlings will not reach the requisite stage for stumping and transplanting during the 1952 planting season. They may, however, be available for planting in 1953.

Applications for supply of planting materials from the Board's nurseries may be made early in 1953 when conditions of sale etc. will be announced.

THE INDIAN RUBBER BOARD

ARBITRATION RULES

These rules for the conduct of arbitrations by the Indian Rubber Board of disputes submitted to it and arising from or in connection with the sale or purchase of rubber were adopted by the Board at a meeting held on the 21st November, 1951.

RULES

A. Introductory

1. These rules shall be called " The Indian Rubber Board Arbitration Rules."

2. In these rules unless there is anything repugnant in the subject or context :—

(a) " The Board " means The Indian Rubber Board.

(b) " The Committee " means the Committee appointed by the Board for supervising and controlling arbitrations under these rules and for exercising the functions of the Board under these rules.

(c) " Rubber " means rubber as defined in Section 3 (h) of the Rubber (Production & Marketing) Act, 1947.

B. Submission to Arbitration

3. Any dispute or difference arising from or in connection with any sale or purchase of rubber shall be determined by arbitration under these rules. The party or parties wishing to submit any dispute or difference to arbitration under these Rules shall fill up, sign and lodge with the Secretary of the Board a submission in the form set forth in the First Schedule hereto or to the like effect together with a deposit of the institution fee and arbitration fee referred to in Rule 20 (a) and also a statement of claim by the party claiming to be aggrieved setting forth the facts and nature of the claim. The statement of claim shall be submitted in quadruplicate.

4. Every submission to arbitration under these rules shall be deemed to contain an undertaking by all parties :—

(a) to be bound by these rules ;

(b) to pay the institution fee, the arbitration fee, the costs and expenses of the arbitrator or arbitrators and umpire and the costs of the arbitration and award, in such manner as may, by the award, be directed ; and

(c) not to take any legal proceedings against the arbitrator or arbitrators or umpire or the Board or any of its officers or the members of the Committee.

C. Appointment of Arbitrators

5. (i) The Committee shall prepare and maintain a panel of arbitrators willing to act as arbitrators. Such panel may from time to time

or at any time be altered or revised by the Committee either wholly or in part.

ii (a) All arbitrations under these rules shall be conducted by persons selected or appointed from the panel of arbitrators.

(b) Arbitrations may be conducted by one arbitrator or two arbitrators and an umpire, or three arbitrators according to the desire of the parties. Unless the parties expressly stipulate, the submission shall be to a single arbitrator.

(c) The Committee shall, upon receipt of a submission, appoint from the panel of arbitrators, an arbitrator or arbitrators and Umpire, as the case may be, and such appointment shall be binding on the parties.

(d) If the reference be to two arbitrators and an Umpire, the Umpire may sit with the arbitrators at the conduct of the arbitration, and in such case; if the arbitrators cannot agree upon their award, the Umpire may make his award either after further hearing or without further hearing as he shall deem fit.

(e) Where the submission is to a single arbitrator the award of that arbitrator shall be final and binding on the parties; where the submission is to two arbitrators and an umpire the award of the arbitrators if they agree on their award, or the award of the umpire if the arbitrators do not agree on their award, shall be final and binding on the parties; and where the submission is to three arbitrators the award of the majority shall be final and binding on the parties.

6. If any arbitrator or umpire dies or becomes incapable of acting or declines to act or to continue to act or becomes in the opinion of the Committee unfit to act, the Committee may either of its own accord or on the application of any party to the submission remove such arbitrator or umpire and appoint some other person to act in his place.

D. Duties and powers of Arbitrators

7. It shall be the duty of the arbitrator, arbitrators and umpire to hear and determine the dispute in accordance with the evidence and his or their own knowledge.

8. The arbitrator, arbitrators or umpire shall hear the evidence and arguments of parties or their agents in the presence of all the parties or their agents. But if one or more parties shall fail to appear at any meeting of which due notice was given, the meeting shall be adjourned to a date not less than seven days thereof and the parties shall be notified of the date of the adjourned meeting, and if any party shall fail to appear at such adjourned meeting, the arbitrator, arbitrators or umpire may proceed in the absence of such party.

9. Notwithstanding anything herein contained, it shall be competent for any arbitrator, arbitrators or umpire, in any case where the

parties so agree, to make his or their award after a comparison or examination of the sample if any and or the contract and the rubber delivered and a perusal of the relevant documents but without hearing oral evidence or arguments. The comparison or examination of rubber as aforesaid may be made through an examiner appointed by the arbitrator, arbitrators or umpire.

10. The arbitrator, or arbitrators and umpire may meet together, adjourn their meetings and conduct the arbitration at such place or places and subject to these rules in such manner as he or they shall deem fit. Reasonable notice shall be given to all the parties or their agents of the place, date and time of every hearing.

11. The arbitrator or arbitrators shall make his or their award within thirty days from the date of his or their entering upon the arbitration; and an umpire shall make his award within seven days of his being informed by the arbitrators that they cannot agree on their award. The Committee may however enlarge the time for making the award of the arbitrator, arbitrators or umpire.

12. The award shall as far as possible follow the form set forth in the Second Schedule hereunder giving the relevant particulars.

13. The arbitrator, arbitrators and umpire shall, in addition to all powers vested in them by law, have power :—

(a) to direct any party to answer such interrogatories as he or they may deem relevant to any of the matters in dispute,

(b) to direct the parties to disclose and produce before him or them any books or documents in the possession of the party and relevant to any of the matters in dispute, or

(c) to direct that the evidence of any witness who is unable to attend may be taken before an examiner, and

(d) to cause notice of any step in arbitration to be served on any party by means of substituted service on any person who has been nominated by or is acting as agent or representative of such party.

14. The arbitrator, arbitrators or umpire shall have power to make such order as he or they may think fit for the interim protection or warehousing of the rubber which is the subject matter of the arbitration.

15. The arbitrator, arbitrators or umpire shall have power to direct that any amount awarded to be paid shall carry interest at such rate not exceeding six per cent per annum, and from such date as he or they shall deem appropriate.

E. Procedure

16. As soon as the Committee shall have appointed an arbitrator or arbitrators and umpire, they shall notify the appointment to all the parties concerned sending a copy of the statement of claim to each

party and shall request the respondent or respondents to state whether the claim is admitted, and if not, to submit a written statement in answer to the statement of claim giving the facts and the nature of his or their defence and/or any counter claim. The time for submission of the written statement shall be ten days from the date of notice or such further time as may be allowed by the Committee, together with such further time as is necessary for a registered letter from the Committee to reach the respondent and for his answer thereto to reach the Committee. If any respondent fails to submit his written statement within the aforesaid time, the arbitrator, arbitrators or umpire may proceed with the arbitration.

17. Except with the permission of the arbitrator, arbitrators or umpire and all other parties, no party may be represented by a legal practitioner.

18. When a party wishes to be represented by an agent, there shall be produced to the arbitrator, arbitrators or umpire a written authority from the principal authorising the agent to appear for him.

19. Service of notice for all purposes under these rules may be given by the Committee, the arbitrator, arbitrators or umpire or by the Secretary of the Board by means of letter or telegram addressed to the party at the address given in the submission or contract or such other address as may be notified by the party. Notice shall be deemed to be given on the date on which the letter or telegram would in the ordinary course have reached the address given. All notices or other communications to the Committee or the Board shall be addressed to the Secretary of the Board at the office of the Board at Kottayam.

F. Arbitration fees, charges, and costs

20. (a) The parties to every arbitration under these rules shall pay to the Secretary of the Board all the arbitration costs including the fees, charges and expenses in accordance with the scale set forth in the Third Schedule hereunder. The institution fees and the fees of the arbitrator or arbitrators and umpire shall be deposited in advance with the submission.

(b) The arbitration award shall state which party or parties are to bear or in which proportion the arbitration costs are to be apportioned between the parties.

(c) Subject as herein provided all arbitration costs shall be paid by the party taking up the award without prejudice to the right of such party to recover the same from the person or persons ultimately liable for the same under the award.

(d) If for ten days after notice to the parties that the award is ready no party takes up the award, then all the arbitration costs as billed by the Secretary of the Board shall forthwith be payable and be paid to the Secretary by the parties who shall be jointly and severally liable for the arbitration costs without prejudice to the right of any party who pays, to

recover the same from any person or persons ultimately liable to pay the same under the award.

G. Award

21. The arbitrator, arbitrators or umpire shall make and sign his or their award in triplicate where there are only two parties together with an extra copy for every additional party and shall deliver the same to the Committee. One copy of the award shall be kept by the Board. After the award has been taken up, any party to the arbitration may have a copy thereof on payment of the fee and charges set forth in the Third Schedule.

22. There shall be no appeal from any award under these rules.

STAMP Rs.

FIRST SCHEDULE

Form of Submission of an existing dispute to Arbitration.

In the matter of.....Arbitration Act, 1940.

WHEREAS a dispute has arisen between us.....of..... and.....of.....which is submitted to arbitration under the Arbitration Act, 1940, in accordance with the Indian Rubber Board Arbitration Rules, and whereas the matters involved in the said dispute are as follows :—

.....

Now we the said.....and.....hereby agree as follows :—

1. That all the said matters in dispute between us shall be determined by the arbitration of an arbitrator appointed in accordance with the said rules.

2. That we will abide by and perform the award of the arbitrator appointed as aforesaid.

3. That we will abide by and perform all interlocutory orders made by the arbitrator in accordance with the said rules.

4. That we will pay the Arbitrators' fees and expenses and such costs as may be by the award directed.

5. That we will not take any legal proceedings against any arbitrator or umpire or the Board or any officer of the Board or any member of the Arbitration Committee of the Board in respect of any matter arising from or in connection with the arbitration.

AS WITNESS our hands the.....day of.....

Witnesses :—

..... (Signed).....

....

STAMP Rs.

SECOND SCHEDULE

Ordinary Form of Award

In the matter of the.....Arbitration Act, 1940.

WHEREAS a dispute has arisen between.....of..... and.....of.....and have submitted such dispute to arbitration in accordance with the Indian Rubber Board Arbitration Rules.

AND WHEREAS the Indian Rubber Board have appointed me .....of.....to be the sole arbitrator to determine the said dispute and I have taken on myself the burden of the reference and have heard the evidence and the arguments adduced by the parties and their representatives.

Now, I, the said.....do hereby make my award as follows :—

1. I award that the said..... .....to pay to the said..... the sum of Rs ....(or that the said.....is not entitled to recover any sum of money from the said... .....)

2. I award that the said .. ../... ....takes delivery of the goods in the terms of the contract with/without allowance.

3. I assess the cost of the arbitration at Rs.....as detailed below :—

....

....

....

4. I direct that the cost of the arbitration and award be paid by the said...../..... .....and if such costs or any part thereof should be paid in the first instance by the said ...../ .....I direct that the said...../..... shall repay the amount thereof to the said...../..... within.....days.

Given under my hand the.....day of.....

Witnesses :—

(Signed)

THIRD SCHEDULE

Scale of Arbitration Fees.

1. Institution fee payable to the Board Rs. 15/- per arbitration.
2. Arbitrator's Fee.
   (a) Each arbitrator Rs. 10/- per ton or part of a ton of rubber which is the subject matter of the dispute subject to a minimum of Rs. 50.
   (b) Umpire Rs. 10/- per ton or part of a ton subject to a minimum of Rs. 50.
   (c) Travelling expenses and travelling allowances, if any incurred on the scale paid by the Board to its members.
3. Actual charges and expenses of handling or examining rubber.
4. Additional charges :—
   (a) Copies of papers may be supplied if demanded, and will be charged for at 6 annas per page of foolscap size folio of 90 words.
   (b) Fee of Rs. 2/- for each certified copy of the award.
   (c) Stamp fees will have to be paid in all cases in accordance with the scale of stamp duties for the time being in force.
   (d) Filing awards : Fees will be payable by the party requiring the award to be filed.

INDIAN RUBBER STATISTICS

TABLE 1.

Total planted area and total estimated tappable area at the end of 1951 in acres:

Planting materials	Estates (100 acres and above)	Small Holdings (Below 100 acres)	Total planted area	Total tappable area
(1) Ordinary seedling rubber	73290	64491	137781	124751
(2) Clonal seedling rubber	7753	1456	9209	4848
(3) Bud-grafted rubber	22074	2127	24201	19140
Total	103117	68074	171191	148739

TABLE 2.

Geographical distribution of planted area in India.

Travancore-Cochin State :—		
Travancore	122548	acres
Cochin	13812	,,
Madras State :—		
Malabar	28319	,,
Canara	410	,,
Nilgiris	861	,,
Coimbatore	644	,,
Salem	132	,,
Madura	407	,,
Mysore State	396	,,
Coorg State	3196	,,
Andamans	407	,,
Assam	50	,,
Bengal	9	,,
Total	171191	,,

TABLE 3.

Size of Small Holdings and Estates

Size class	No. of Units	Area in acres	Percent of total area
(1) Small Holdings :—			
Under 1 acre	2421	1388	0·8
Of and over 1 acre and under 5 acres	8336	18252	10.7
Of and over 5 acres and under 10 acres	1471	9794	5·7
Of and over 10 acres and under 50 acres	1321	25128	14·7
Of and over 50 acres and under 100 acres	201	13512	7·9
Total small holdings :—	13750	68074	39·8
(2) Estates :—			
Of and over 100 acres and under 500 acres	200	39839	23·3
Of and over 500 acres and under 1000 acres	30	21031	12·3
Of and over 1000 acres and under 1500 acres	17	20870	12·2
Of and over 1500 acres and under 2000 acres	5	8983	5·2
Of and over 2000 acres	5	12394	7·2
Total Estates :—	257	103117	60·2
Grand Total :—	14007	171191	100·0

Average size of small holdings : 5·0 acres.
Average size of estates : 401·2 acres.

TABLE 4

Area, in acres, of New Planting and Replanting, 1938—1951 and Planting Material Used.

Year	New Planting				Replanting				Gr. Total
	Ordinary seedling	Clonal seedling	Bud grafts	Total	Ordinary seedling	Clonal seedling	Bud grafts	Total	
1938	485	5	486	976	5	..	791	796	1772
1939	1078	527	1465	3070	83	..	865	948	4018
1940	1196	507	1064	2767	106	..	792	898	3665
1941	727	31	110	868	..	56	1200	1256	2124
1942	2972	449	363	3784	219	60	1899	2178	5962
1943	9990	1790	2657	14437	192	..	113	305	14742
1944	8290	1095	1052	10437	528	..	405	933	11370
1945	6358	2313	609	9280	94	67	..	161	9441
1946	2805	638	375	3818	234	15	170	419	4237
1947	1348	384	466	2198	77	..	428	505	2703
1948	420	72	149	641	200	71	365	636	1277
1949	514	194	88	796	50	49	202	301	1097
1950	306	31	..	337	558	280	241	1079	1416
1951	59	15	156	230	8	231	355	594	824
Total	36548	8051	9040	53639	2354	829	7826	11009	64648

TABLE 5

Area of Replanting on Estates and Small Holdings in acres, as on 31-12-1951

Year	Estates				Small Holdings				Total estates & small holdings
	Ordinary seedling	Clonal seedling	Bud grafts	Total	Ordinary seedling	Clonal seedling	Bud grafts	Total	
Replanted earlier than 1938	9	...	1962	1971	8	...	...	8	1979
,, during 1938	...	...	791	791	5	...	...	5	796
,, ,, 1939	66	...	840	906	17	...	25	42	948
,, ,, 1940	87	...	792	879	20	...	...	20	899
,, ,, 1941	...	56	1190	1246	...	...	10	10	1256
,, ,, 1942	189	60	1899	2148	30	...	...	30	2178
,, ,, 1943	142	...	113	255	50	...	...	50	305
,, ,, 1944	528	...	405	933	...	...	...	...	933
,, ,, 1945	81	67	...	148	13	...	...	13	161
,, ,, 1946	234	15	170	419	...	...	...	...	419
,, ,, 1947	77	...	428	505	...	...	...	...	505
,, ,, 1948	189	71	365	625	11	...	...	11	636
,, ,, 1949	47	49	202	298	3	...	...	3	301
,, ,, 1950	549	265	233	1047	8	15	8	31	1078
,, ,, 1951	4	194	355	553	4	37	...	41	594
Total	2202	777	9745	12724	169	52	43	264	12988

TABLE 6.

Production, dry weight in tons, 1941—1951.

Year	Estate of and above 100 acres.	Small holdings (below 100 acres).	Total
1941	10861	5434	16295
1942	11050	5529	16579
1943	10645	5984	16629
1944	11198	5976	17174
1945	10839	5238	16077
1946	10493	5179	15672
1947	10988	5461	16449
1948	10951	4471	15422
1949	11448	4139	15587
1950	11431	4168	15599
1951	12459	4689	17148

TABLE 7.

Monthly Production, dry weight in tons, 1948—1951.

Months	1948	1949	1950	1951
January	1425	1326	1291	1307
February	270	257	208	260
March	956	798	988	902
April	1498	1563	1640	1664
May	1646	1240	1450	1808
June	694	854	836	562
July	844	904	758	1258
August	1068	1245	1053	1654
September	1646	1410	1414	1756
October	1796	1944	1937	1807
November	1742	2011	1975	1981
December	1837	2035	2049	2189
Total	15422	15587	15599	17148

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TABLE 8.

Monthly consumption of Raw Rubber (indigenous and imported) by Rubber Goods Manufacturers (Tons), 1948—1951.

Months	1948	1949	1950	1951
January	1587	1548	1162	1868
February	1494	1414	1295	1894
March	1587	1284	1320	1821
April	1668	1981	1435	2134
May	1432	1847	1372	1576
June	1875	1770	1517	1131
July	1801	1785	1800	2077
August	1902	1819	1670	2007
September	1753	1638	1506	1953
October	1109	1068	1253	1788
November	1700	1697	1737	2061
December	1811	1341	1668	2117
Total	19719	19192	17735	22427

TABLE 9.

Imports of Raw Rubber during 1948—1951 (Tons).

Months	1948	1949	1950	1951
January	...	501	339	945
February	...	354	41	1377
March	...	954	44	1124
April	...	691	...	850
May	...	9	132	521
June	315	71	44	477
July	705	...	...	843
August	444	...	...	115
September	941	3	...	185
October	649	2	75	243
November	595	66	175	136
December	684	116	232	105
Total	4333	2767	1082	6921

TABLE 10.

Production, Consumption and Stocks of Indigenous Rubber, 1951, (Tons.)

Group	Production	Consumption of indigenous production by local manufacturers	Stocks with estates and dealers as on 31–12–'51.	Stocks in transit sold to manufacturers as on 31–12–'51.	Stocks of indigenous rubber with manufacturers as on 31–12–'51.
Group 1	6606	6178	1199	847	849
Group 2	3152	3386	575	266	112
Group 3	1332	1274	306	46	88
Group 4	1218	776	269	34	139
Group 5	833	1194	328	253	8
Group 6	570	718	285	97	104
Group 7	37	95	37	4	34
Scrap Grades	1770	222	606	16	40
Latex (D. R. C.)	914	580	385	12	83
Sole Crepe	716	214	217	..	34
Estimated unspecified	..	905*	..	..	100*
Total	17148	15542	4207	1575	1881

*Estimated consumption by and stocks with some manufacturers from whom returns have not been received.

Rubber Prices in Ceylon and India

Grades	Average monthly F. O. B. Colombo prices for 100 lbs. (1951)			Controlled Indian Minimum F. O. B. Cochin prices for 100 lbs. from 21-5-1951.
	Oct.	Nov.	Dec.	
	Rs.	Rs.	Rs.	Rs.
RMA 1	241·25	227·35	215·06	127·00
RMA 2	235·19	220·35	208·25	125·50
RMA 3	228·00	211·30	201·06	124·00
RMA 4	199·63	185·25	184·81	120·50
RMA 5	169·13	152·20	142·44	116·50
Pale Latex Cr. IX	269·06	269·65	269·13	130·50
Do. I	259·19	262·40	260·06	128·50
Flat Bark	127·94	126·70	122·75	91·50

Exports:

1950 – 720 tons Group I
280 tons Group II
38 tons Sole crepe

1951 – 140 tons Sole crepe

1952 – 78 tons Sole crepe (Jan – August)

1931 J

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PRICE CONTROL OVER RAW RUBBER

GOVERNMENT OF INDIA
MINISTRY OF COMMERCE & INDUSTRY
RESOLUTION—TARIFFS.

New Delhi, the 8th March, 1952.

No. 3—T (2)/52. The prices of the various grades of Raw Rubber were fixed under Section 13 of the Rubber (Production & Marketing) Act, 1947, by the Ministry of Commerce and Industry Notification No. 759, dated the 21st May 1951 for a period of one year.

2. As Government have decided to continue the control on price and distribution of Raw Rubber, it is necessary to fix prices for Raw Rubber after the 20th May, 1952. The Tariff Commission is accordingly requested to conduct the necessary enquiries in regard to the cost of production of Rubber and to submit to Government as early as possible its recommendations as to the prices to be fixed.

K. N. KAUL,
Joint Secretary.

FORMIC ACID 'RHODIA'

VOLKART

VOLKART BROTHERS

Ready stock available at
COCHIN, ALLEPPEY, KOTTAYAM AND KOZHIKODE

DITHANES and YELLOW CUPROCIDE protect many crops against many diseases. Rubber planters find these fungicides specially effective for the control of LEAF FALL and BLACK THREAD and other diseases of HEVEA.

For effective control of INSECTS use RHOTHANE DDD.

Chemical control is an economical solution to many costly WEED problems, commercial practice has shown that KATHON weed killers have a wide application in agriculture.

AMRITLAL & COMPANY, LTD.,
11 Sprott Road,
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Printed and Published by K. N. Kaimal on behalf of the Indian Rubber Board, at the C. M. S. Press, Kottayam.