

Report

ON

THE RUBBER INDUSTRY

OF THE

ORIENT

(INCLUDING CEYLON, THE MALAY PENINSULA,
JAVA AND SUMATRA).

BY

C. E. AKERS.

1912.

PRINTED AND PUBLISHED BY
WATERLOW & SONS LIMITED, LONDON WALL, LONDON.

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FIVE SHILLINGS NET.

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THE RUBBER INDUSTRY
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MEMBERS OF THE COMMISSION OF INVESTIGATION.

MR. C. E. AKERS,
DR. JACQUES HUBER,
MR. A. UFENAST,
MR. F. LUGONES.

1911-12.

INTRODUCTORY.

In accordance with the instructions given at the meetings held in the office of the Port of Pará, at Paris, on December 11th and 12th, the Commissioners proceeded to Marseilles and embarked on board the Orient Line steamer, "Ombrah," on December 13th, proceeding thence to Colombo, and reaching that port on December 29th.

The object of the mission was to make a thorough investigation into the conditions and scope of the rubber industry in the East, and for this purpose to visit Ceylon, the Malay Peninsula, Java and Sumatra. The principal points to be considered were :—

1. The present and future cost of production per pound of rubber.
2. The area of the Eastern plantations, and the producing capacity of the estates.
3. The area of the lands available for the extension of the industry.
4. The conditions of the present and future labour supply available for plantation work in the countries visited.
5. To consider the question of the cultivation of catch crops in connection with the rubber plantation.

With the above ends in view the Commissioners made a careful examination of the principal rubber producing districts in Ceylon, the Malay Peninsula, Java and Sumatra, and the results of that investigation are contained in the detailed reports drawn up in connection with each of those countries, and, finally, in the summary showing the total production anticipated for the next few years, together with the probable average cost per pound of rubber placed in the markets of Europe.

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REPORT
ON THE
RUBBER INDUSTRY OF CEYLON.

CURRENCY UNIT: 1 RUPEE = 16 PENCE.

MEMORANDUM ON CEYLON RUBBER ESTATES.

LOCALITY.

The Commissioners visited the districts in the South-West portion of the Island, where the principal rubber plantations are situated. They are comprised within an area lying five miles in a direct line from the seaboard and extend from Galle on the South Coast, northwards to Kandy and Matale; from the latter point westward to Kurunegala, and from that place in a south-westerly direction towards Negombo; thence to Colombo, Kalutara and Alutgama. Nine-tenths of the rubber industry is within this zone.

EXTENT.

The total extent of the rubber estates of Ceylon in 1911 was 215,000 acres.* The land cleared and now ready for immediate planting is, approximately, another 10,000 acres. Therefore, for the purpose of this report, the planted area may be considered as 225,000 acres. There remains a large reserve of land, probably not less than 200,000 acres suitable for rubber planting. These lands are owned partly by the Crown and partly by private persons. In the latter case the values have risen very greatly during the past five years, and as a result planters are unwilling at present to pay the price demanded by the proprietors, who for the most part are Sinhalese. Crown lands are sold by public auction on the application of the would-be purchaser. In this case also the average price per acre has advanced to three and four times the value ruling a few years ago. The reserve price of these lands is placed at a low figure (not less than Rs. 15/- per acre; but sales at Rs. 100/- per acre are not uncommon), and even higher prices occasionally are recorded.

TENURE OF LAND.

The land is freehold, with title direct from the Crown. The only exceptions are certain tracts claimed by Sinhalese in virtue of long occupation and cultivation. On these areas no rubber plantations have yet been opened.

TAXATION.

No direct taxation is imposed on the rubber growing industry. The public revenue is derived from import duties, licenses, stamps, sales of land, and other indirect sources. A small contribution of 1½ rupees *per capita* is enacted for the maintenance of public roads, but members of any volunteer military organisation in Ceylon are exempted from payment. Indian coolie labourers are also exempt from this tax.

ELEVATION ABOVE SEA LEVEL.

The altitude of the rubber growing districts varies from a few feet above sea level in the Kaltura, Kelani Valley and other districts to that of 1,700 feet at Peradeniya and the vicinity of Kandy. The development of Pará rubber

* In March, 1912, the *Times* of Ceylon, when dealing with this subject, gave the total area under rubber as 234,000 acres.

trees, at elevations from sea level to a height of 700 feet in the districts of Kelani Valley, Kaltura and those lying to the south of Adam's Peak, is undoubtedly much greater than is obtained at the higher elevations around and to the north of Kandy, but this may be accounted for to a very great extent by the more abundant rainfall.

RAINFALL.

The rainfall is very unevenly distributed throughout the Island. To the south of the range of mountains, of which Adam's Peak is the central point, the annual rainfall varies from 132 inches to 170 inches. In the neighbourhood of Kandy it is from 72 inches to 92 inches. In the district of Matale it averages 75 inches. In the north, at Anuradhapura and the surrounding districts, the annual fall is frequently below 40 inches. The rains brought by the north-east and south-west monsoons are precipitated by the mountain ranges in the vicinity of Adam's Peak, 7,200 feet above sea level.

SOIL.

The soil throughout the rubber growing districts is laterite, or a gritty and somewhat sandy red loam. A large proportion of the planted sections were cultivated many years before the introduction of the rubber industry, and humus and topsoil have been washed away by the constant heavy rainfall. Many plantations are located on rocky hillsides, and the trees are thriving under those conditions. To remedy the effects of the loss of topsoil the practice of manuring has become accepted as a necessity on nearly all plantations, and this work is commenced immediately the young trees are planted. The general rule is to apply 840 pounds of superphosphates, mixed with other artificial fertilisers, per acre during the first six years of the plantation, and subsequently to continue this treatment when the trees are being tapped. Green crops also are grown amongst young trees for purposes of manuring, and have given some excellent results. It remains to be seen how far manuring will benefit the trees when further development permits them to resume a forest character.

FOUNDATION OF THE RUBBER INDUSTRY.

The rubber industry in Ceylon owes its foundation to seeds collected in 1876 by Mr. Wickham, in the vicinity of the River Tapajós, in the Amazon Valley. These were germinated at Kew, and plants then sent to Ceylon and set out in the gardens at Heneratgoda and Peradeniya. Seeds from these trees were distributed freely between 1881 and 1891, but the idea prevailed that only marshy ground was suitable for their growth and little interest was taken in their cultivation. A few experiments, however, were made of planting them on hillsides, and these proved so successful that the area rapidly increased. Between 1898 and 1904 a large number of tea plantations were interplanted with rubber trees, and from the latter date the extension of existing plantations and the opening up of new ones has been pushed forward with energy and method. The industry to-day is established firmly in Ceylon and promises to become quite as staple as the cultivation of tea, rice, cacao or coconuts. An indication of the way it has taken root is seen in the many small patches of rubber trees planted by the Sinhalese near their houses and villages.

HEALTH OF RUBBER TREES.

In all the districts visited the Commissioners found the trees to be in sound and healthy condition, whether at high or low altitudes. A little fungus leading to canker exists in some localities, but not to an extent threatening any serious loss to plantations. A certain percentage of the older trees have been damaged by bad tapping through inexperience, but the majority of these show

every indication of practically complete recovery. A few insect pests were noticed, but none of any serious importance. From all causes a liberal estimate of the loss of trees on the existing rubber plantation should not exceed three per cent. The worst enemy to the rubber industry is wind. Where continuous strong winds prevail a stunted growth results; but it is only in a few localities, for instance certain sections of the Matale district, where plantations are exposed to strong prevailing winds, and then only on the higher ridges, that this condition was observed.

EFFECT OF THE RUBBER BOOM ON CEYLON ESTATES.

The majority of the rubber estates established previous to 1904 were due in great part to the fact that rubber was interplanted with tea as a shade tree for the latter. As the trees developed the tea was abandoned, owing to the shade becoming too dense to allow of profitable cultivation. In these conditions the initial cost of such rubber estates for all practical purposes is *nil*. When the rubber boom began many of these properties were purchased and companies formed in London and elsewhere for their acquisition. In some cases exorbitant prices were paid, but, as a general rule, the valuation was not excessive in view of the price at which rubber was selling in Europe. Since 1904, new estates have been opened up and additional acreage added to existing estates, but as a rule this work has been carried out on a conservative basis of cost. The same conditions apply to estates being planted and developed at the present time, with the exception of the higher price prevailing for suitable land.

CAPITALISATION OF CEYLON RUBBER ESTATES.

As has been pointed out the older plantations, where rubber has taken the place of tea, can hardly be said to have any original capital value, unless the cost of bringing the tea under cultivation in former years is taken into consideration. What happened was, that local companies were formed to obtain control of groups of these former tea estates. These, again, were sold to companies formed in London with sterling capital. One such group was the Grand Central, which now has 12,500 acres under rubber. In this case the properties were turned over by the vendors at a valuation of £95 per acre. Another instance is the small property of Doranakandy, which was purchased for £44,000, contains 220 acres of rubber trees now averaging twelve years old, and will yield 120,000 to 130,000 pounds of rubber in 1912. In very few instances do any fixed interest charges exist, nearly all development being carried out by the money subscribed for the shares. The cost of opening up a new plantation and maintaining it properly, but with strict regard to economy in expenditure until the trees are six years old, averages £30 per acre for estates of from 500 to 1,000 acres, this including purchase price of land and the necessary buildings and machinery. A carefully checked estimate, furnished by a most reliable and practical planter, places the cost of a thoroughly well equipped factory, capable of handling not less than 300,000 pounds of rubber yearly, at a sum not exceeding £3,300. The machinery now in general use is simple, effective and not costly. Oil engines burning liquid fuel give the motive power. These engines are generally supplied by Hornsby & Co., or Crossley & Co., and the fuel costs, approximately, threepence per gallon delivered on the estate. The creping and washing machines cost £95 each delivered at the factory. The most modern washing machines for scrap are more expensive, and run as high as £250, but only one is required when handling a crop of 300,000 to 400,000 pounds of rubber. The only other machine required is the dryer; one with two chambers of the Passberg patent would be required for a crop of the amount mentioned and could be installed for, approximately, £800. A less costly dryer, but not so effective, is supplied by the Colombo Commercial Company for £260.

WORKING EXPENSES.

For an estate of 1,000 acres of rubber six years old, the working expenses should be, approximately, as follows:—

1. Collecting and curing	...	...	...	...	Rs.	50,000
2. Maintenance of roads and drains	...	...	...	...	"	5,000
3. Weeding	...	...	...	...	"	6,000
4. Manuring	...	...	...	...	"	18,000
5. Cultivation (forking over land, etc.)	...	...	...	...	"	12,000
6. Management (manager, 2 European assistants, chemist, 2 conductors, clerks, etc.)	...	...	...	...	"	25,000
7. Depreciation on buildings, machinery	...	...	...	...	"	15,000
8. Transport	...	...	...	...	"	3,000
9. Colombo Agents' commission	...	...	...	...	"	4,000
10. Contingencies	...	...	...	...	"	10,000
						<hr/>
					Total	Rs. 148,000
						<hr/> <hr/>

Allowing for the high rate of exchange now ruling this equals £10,000. Of this total expenditure two-thirds, or 100,000 rupees, is for payment to labourers employed on the estate. The average rate of wages for men, women and children is 35 cents per day for Tamil coolies, and for an estate of 1,000 acres about 1,000 coolies are required, working twenty-four days in each month.

RECEIPTS FROM YOUNG ESTATES.

The total yield from an estate of 1,000 acres of six-year-old trees, in districts such as Kalutara or Kelani Valley, would be 150,000 pounds of dry rubber, equal to one pound of dry rubber per tree or 150 pounds per acre. Of this yield 80 per cent. will be of fine quality and 20 per cent. scrap. Values in Colombo to-day range from four shillings and threepence to four shillings and sixpence per pound for fine plantation. At these prices the value of the crop of 150,000 pounds would be, in round figures, £30,000 sterling, leaving a nett profit of £20,000 to the estate. If prices fall to half the present value the nett profit would be £5,000 on an estate of 1,000 acres of six-year-old trees, representing a capital investment of £30,000 sterling. The yield should increase steadily during the succeeding years in much greater ratio than the cost of production, and when the trees are twelve years old, the output from 1,000 acres of 150 trees per acre should not fall short of 450,000 pounds of dry rubber. When this period of development is reached the average cost per pound of dry rubber, placed f.o.b. Colombo, should be as follows:—

	Cents.	
1. Collecting-	20	Including maintenance of drains and roads.
2. Curing	6	Including depreciation of factory and machinery.
3. Management	7	Including all charges connected with administration.
4. Weeding	2	This figure is considered somewhat high.
5. Manuring	6	Allows 27 rupees per acre per annum.
6. Cultivation	2	Forking over land, cutting out, pruning, etc.
7. Transport	2	Practically a permanent charge.
8. Colombo agents	2½	Do. do. do.
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	47½	
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Allowing 2½ cents per pound for all unforeseen contingencies, production should not cost more than 50 cents per pound, equal to eightpence sterling.

The charges per pound from Colombo to London at present are :—

	Pence.
1. Freight at 65s. per 50 cubic feet	·70
2. Allowance to buyer $2\frac{1}{2}\%$ and $1\frac{1}{2}\%$	1·50
3. Brokerage $\frac{1}{2}\%$	·25
4. Insurance, sale charges and other expenses $1\frac{1}{2}\%$	·75
5. Merchants' commission 1%	·50
	<hr/>
	3·70
	<hr/> <hr/>

With a drop in the value of rubber to 2s. per pound these charges, with the exception of that for freight, will be correspondingly reduced.

From the data given it will be seen that the total cost of Ceylon rubber from estates, with trees averaging twelve years of age, should not exceed 1s. per pound placed in the London market. If shipped to Hamburg the cost would be further reduced as the allowance to buyer is only $\frac{1}{2}\%$, and not $2\frac{1}{2}\%$ and $\frac{1}{2}\%$ as in both London and Liverpool.

ORGANISATION OF RUBBER ESTATES.

In opening up an estate on forest areas the work of felling the timber, lopping and burning is given out to contractors, the usual price paid being Rs. 15s. per acre. Lining, holing and filling costs Rs. 4s. per acre. Weeding is done by contract at Rs. 1s. 2d. per acre per month for the first year, Rs. 2 per acre per month the second year, and Rs. $1\frac{1}{2}$ per acre per month the third year. The price is then gradually reduced until it reaches 60 cents, or sometimes as low as 50 cents per acre per month, and it continues to be an annual charge at this rate. In Ceylon trees have been planted at varying distances apart during past years, but the measurements, at present accepted as most satisfactory, are 20 feet by 15 feet, giving 149 trees to the acre. As a rule two-year-old stumps are used in planting an estate; but some very successful results have been obtained from putting out seeds at stake, although there is always danger of injury from rats. The planting of catch crops between the lines of rubber trees is now generally deprecated as seriously retarding their growth, and the practice has been abandoned with few exceptions. Tapping is begun on trees when five years old, if the girth is 18 inches or more at three feet from the base. The method in general use is the herring bone. Women, and children of 14 to 16 years, are largely employed for this work, and become expert tappers. Tapping begins at daybreak and by 10 a.m. the bulk of the latex is delivered at the factory, where it is mixed with an equal quantity of water and then treated with acetic acid (1 part acid to 325 parts latex) to produce coagulation; it is then passed through the washing and creping machines and thence to the dryer. The proportion of rubber to latex is, approximately, 1 pound of dry rubber to 1 gallon of latex. From the dryer the rubber is conveyed to rooms where it is hung for some days. It is then packed in wooden boxes containing 112 lbs. nett each, and is ready for shipment to Colombo, where it is received and stored by agents until shipped or sold locally.

With regard to frequency of tapping, experience shows that the results from daily tapping, or from tri-weekly, differ very little at the end of a year as to total yield. With the exception of February and March, when the weather is dry and the trees changing leaf, tapping continues throughout the year.

YIELD PER TREE.

The ages of trees on Ceylon estates vary so greatly that it is difficult to obtain accurate statistics of yields over any large acreage. At Culloden Estate, in the Kalutara district, a section comprising 79 trees gave the following results :—

Years.		Age of trees.		Yield.	
1908	...	5 years old	...	·77 pounds.	
1909	...	6 " "	...	1·02	"
1910	...	7 " "	...	2·11	"
1911	...	8 " "	...	2·50	" (Probably a little more was obtained, as the return for December was not worked out.)

On the same estate a field of 62 acres of ten-year-old trees yielded per acre 700 pounds of dry rubber in 1911, while another field of 46 acres also of ten-year-old trees gave a return of 500 pounds of dry rubber to the acre. At Doranakandy 220 acres, averaging twelve years old, yielded 85,000 pounds of dry rubber in 1911, and is estimated to give 110,000 pounds in 1912. The Manager, however, states this to be a very low estimate, and that it will probably be exceeded by 12,000 or 15,000 pounds, so that the average yield per acre should be over 500 pounds of dry rubber. On the Sunnycroft Estate 4,950 trees, $7\frac{1}{2}$ to $8\frac{1}{2}$ years old, yielded in 1910-11 an average of 2·53 pounds of dry rubber per tree in ten months tapping. The number of trees to the acre have no very great bearing upon the yield, except in the early stages of tapping, for, when widely planted, the extra growth and girth and consequent greater yield compensate for the lesser number.

ADVANTAGES OF RUBBER PRODUCTION IN CEYLON.

There are many advantages in Ceylon for growing rubber. It is true that suitable land is not cheap, nor is it always easy to obtain. But the industry is well established; transport facilities are excellent; the organisation of estates is based on long experience gained in the cultivation of tea and coffee; competent superintendents can be obtained to undertake the work of administration; taxation is practically non-existent; and the general condition and productiveness of the trees is distinctly satisfactory. The renewal of bark after tapping is rapid and leaves little to be desired. Third renewals in both the Kelani Valley and Kalutara districts are exceptionally healthy and yield latex freely. While malarial fever is not uncommon amongst labourers it is rarely of sufficient importance to affect seriously the work on the plantations. Government dispensaries and hospitals are established in all districts, and these are attended to by resident Government Medical Officers.

THE LABOUR QUESTION.

In 1911, official statistics showed 550,000 Indian coolies, and 150,000 Sinhalese and other nationalities engaged in agricultural work in Ceylon. On September 30th, 1911, the returns showed 421,305 Indian coolies employed on 1,830 estates. Of these 421,305, the males numbered 218,709 and females 202,596. The great majority of these labourers are thoroughly conversant with ordinary plantation work, and a very large percentage of them are rapidly becoming skilled tappers. The children grow up on the estates, and develop ability and intelligence in all branches of rubber production, as has been the case in connection with coffee and tea planting in former years. Nearly all these coolies are Tamils, immigrating to Ceylon from Southern India, from districts containing a population of some 30,000,000. With the linking up of the Ceylon railway system with that of Southern India the transport facilities for these immigrants will be greatly improved. The coolies are recruited by Kanganies for the estates, and the cost of their passages is advanced by planters. They are under no indenture, although an indenture ordinance exists in Ceylon, and, after due notice and payment of any indebtedness, they can leave

the estate for employment elsewhere. Many complaints are heard in regard to this condition of affairs ; but, on the whole, the system works on fairly satisfactory lines. The wage rate varies from 40 cents for men to 25 cents for women, and 18 cents for boys and girls from 13 to 16 years of age. There is a slight tendency to a higher wage rate, induced probably by the demand from the Malay Peninsula for this same class of coolies.

The hours of work in Ceylon are from 6 a.m. to 4 p.m. on six days in the week, but a very great proportion of the work is by task, and can, as a rule, be finished much earlier in the day. Discipline on the estates is well maintained, and it is seldom any serious dispute arises between employer and labourer. The standard of living is low according to European ideas, but adequate for this class of labourer. They are well housed in permanent lines, constructed with steel frames, galvanised iron roofing, plastered walls and six foot verandahs. These barracks are divided into rooms, 10 feet by 12 feet, and four coolies are allotted to each room. As a rule, the buildings contain twelve rooms and cost Rs. 120/- per room. The distribution of the rooms is left to the discretion of the head Kangany. The food consists of rice, supplemented by curry, dried fish, vegetables and fruit. Occasionally meat and chickens are eaten, but not as a regular diet. Rice is supplied at cost price by the estates and always at a much cheaper rate than in the bazaars. The estates are compelled to establish and maintain free primary schools for the benefit of the children of the Indian coolies employed.

In addition to the Tamil labourers, the Sinhalese are now employed much more frequently than formerly. The objection raised by the planters to this class of labour is that the wage rate is higher, averaging fifty cents per diem in place of thirty-five cents ; also, that it is not possible to maintain the same standard of discipline as with the Tamils. The Sinhalese is close to his own home, and when he is tired of work he takes his wage and departs. In wet weather he will not turn out, and when his village is busy harvesting rice or other products, he prefers that employment to work on an estate.

FUTURE PRODUCTION AND COST.

In regard to the future production of rubber in Ceylon within the next seven years, if the present average yield is applied to 225,000 acres and is taken as a basis for calculation, there can be small doubt that in 1919 the average production should be at the rate of not less than four hundredweights per acre. This would give a total output available for exportation of 45,000 tons. This may be regarded as a minimum figure, for extensions of the present cultivated area will assuredly occur from year to year, and these may even duplicate the area of the existing plantations in the course of another fifteen or twenty years. In 1910, the exportation from Ceylon, in round figures, was 1,500 tons ; in 1911, it rose to 3,000 tons ; in 1912, it will be not less than 6,000 tons ; in 1913, the amount will certainly reach 10,000 tons ; in 1914, the export will exceed 15,000 tons ; in 1915, additional large areas come into bearing, and the exportation will not fall far short of 25,000 tons. Substantial increases will take place in the three years following, and, in 1919, the production will be, approximately, 45,000 tons with the prospect of further steady development.

So far as can be seen at present the average price of production of Ceylon plantation rubber, f.o.b. Colombo, should not exceed 8d. per pound, although, in many cases, the cost may be considerably below that figure.

In this memorandum the question of Pará rubber (*Hevea Braziliensis*) only has been dealt with. Ceara grows well in various districts, but is not much in favour, owing to difficulty in tapping, and for the same reason castilloa has proved a failure wherever its cultivation has been attempted.

The accompanying appendices are self-explanatory.

COLOMBO, 18th January, 1912.

APPENDIX I.

DISTRIBUTION OF COST WHEN OPENING AN ESTATE.

EXPENSES FIRST 6 YEARS.

	Rupees.
1. Value of 1,200 acres of forest land at Rs. 60 per acre	72,000
2. Felling, lopping, burning and cleaning 1,000 acres	15,000
3. Weeding 1,000 acres for six years	90,000
4. Draining 1,000 acres	15,000
5. Roads and bridges	20,000
6. Holing, lining and filling on 1,000 acres	4,000
7. Planting and supplying	2,000
8. 200,000 two-year-old plants	6,000
9. Building and equipment of factory	50,000
10. „ Bungalows for Manager, assistants and conductors... ..	20,000
11. „ Lines for coolies	24,000
12. Purchase of tools, etc.	10,000
13. Manuring	45,000
14. Management for six years	90,000
Total	Rs. 463,000
Value of 200 acres forest	12,000
Capital value 1,000 acres rubber	Rs. 451,000

This allows a high rate of cost for all work, and for the erection of first-class permanent buildings, but does not include outstanding coast advances, amounting probably to not less than Rs. 50,000.

APPENDIX II.

TABLE SHOWING DEVELOPMENT OF THE RUBBER INDUSTRY
IN CEYLON DURING THE PAST NINE YEARS.

Years.	Acres planted.	Export.
1904 ...	25,000 ...	35 Tons.
1905 ...	40,000 ...	75 „
1906 ...	100,000 ...	150 „
1907 ...	150,000 ...	250 „
1908 ...	180,000 ...	400 „
1909 ...	184,000 ...	681 „
1910 ...	204,000 ...	1,500 „
1911 ...	215,000 ...	3,000 „
1912 ...	225,000 ...	6,000 „ (estimated).

REPORT

ON THE

RUBBER INDUSTRY OF THE MALAY PENINSULA.

CURRENCY UNIT: 1 DOLLAR = 28 PENCE.

MEMORANDUM ON THE RUBBER INDUSTRY IN THE MALAY PENINSULA.

LOCALITY.

The Commissioners visited the principal centres of the rubber planting districts situated between Singapore and Penang. These include the native State of Johore, the Federated Malay States of Negri Sembilan, Selangor and Perak, and the Settlements of Malacca, Province Wellesley and Penang.

In the State of Johore the development of rubber estates has been retarded by lack of transport facilities, but it is now making rapid progress.

In Pahang similar difficulties exist, and these in conjunction with the mountainous nature of the country have resulted in only a limited number of plantations being opened.

In Kelantan, where the soil is well adapted for rubber-growing and labour abundant, insufficient means of communication have hitherto restricted planting enterprise, but the construction of railways and roads now being pushed forward will alter these conditions very shortly. These remarks also apply to the native State of Trengganu.

In Kedah the area planted with rubber is extending rapidly, and communication by road is now open between the principal centres and the Province Wellesley.

Along the railway through the Federated Malay States from Tampin in Negri Sembilan to Penang, the cultivation of rubber estates is practically continuous, although broken at intervals by Government forest reserves and occasionally by tin-mining operations. For the greater part of this distance the planted area to the west of the railway extends to the seaboard, and to the east to the foothills of the mountain ranges intersecting the Peninsula. To give an idea of the extension of this area it may be approximately calculated at 200 miles long, averaging 5 miles wide, and containing a total of some 640,000 acres. To the south of these districts from Tampin to Singapore, a distance of 150 miles, passing through the State of Johore, the cultivation is more scattered along the line of railway, but is increasing rapidly.

AREA OF RUBBER ESTATES.

Absolutely accurate returns of the acreage planted throughout the Peninsula are not available to show the cultivated area in 1912. In 1910 the figures were given officially as 362,000 acres, but all enquiries tend to indicate that the statement was only an approximate one. The difficulty lies in the fact that many Chinese proprietors of large holdings do not make any return; nor do the very numerous class of Malays and Chinese owners of small patches planted with rubber, but cultivated also with other crops between the trees. In the Federated Malay States the export duty of $2\frac{1}{2}$ per cent. on the value is no check upon the acreage, as the ages of the trees vary from those newly planted to 12 years old. In the Settlement of Malacca the assessment tax on trees is an equally unreliable guide, for it only takes effect on trees of 6 years and upwards. In the native States no returns are available, and the area can only be estimated. In view of these circumstances I made a particular point of obtaining the estimates of acreage at each centre of cultivation from visiting agents, resident planters, Government officials, business men, and also of Secretaries of Planters' Associations and others

interested in the industry. Finally, in Penang I revised these estimates with the assistance of the Secretary to the Planters' Labour Association, who has returns from 485 estates in connection with the distribution of all Indian immigrants, these being brought to Penang in accordance with the quarantine regulations. If the official figures are taken from 1906 to 1910, and the estimated additional planting in 1911, together with the area now ready for planting, the total result shows 650,000 acres under rubber. The very large area planted in 1911 and the acreage now ready for planting is due to the great amount of capital subscribed for rubber enterprises during the boom of 1909-10. The following table shows the expansion of the rubber industry in the Malay Peninsula during the last six years :—

		Acreage.	Planted each year.	Rubber exported. Tons.
1906	...	99,230	—	430
1907	...	179,227	79,997	485
1908	...	241,138	61,911	1,629
1909	...	292,035	50,897	3,340
1910	...	362,853	70,818	6,504
*1911	...	538,000	176,000	10,700
1912	...	650,000	112,000	21,000

(now ready for planting). (estimated).

This area of 650,000 acres is distributed as follows :—

								Acres.
1.	Federated Malay Estates	...	...	...	...	...	...	406,000
2.	Malacca	...	...	...	...	...	...	118,000
3.	Province Wellesley and Penang	...	...	...	...	...	...	25,000
4.	Kedah	...	...	...	...	...	...	10,000
5.	Kelantan	...	...	...	...	...	...	15,000
6.	Johore	...	...	...	...	...	...	61,000
7.	Singapore	...	...	...	...	...	...	13,000
8.	Trengganu	...	...	...	...	...	...	2,000
								650,000

The area of 112,000 acres now ready for planting is as follows :—

								Acres.
1.	Federated Malay States	...	...	...	...	...	...	55,000
2.	Johore	...	...	...	...	...	...	18,000
3.	Malacca	...	...	...	...	...	...	17,000
4.	Kelantan	...	...	...	...	...	...	10,000
5.	Kedah	...	...	...	...	...	...	5,000
6.	Singapore...	...	...	...	...	...	...	5,000
7.	Province Wellesley and Penang	...	...	...	...	...	...	2,000
								112,000

In addition to the 650,000 acres now under cultivation, an area of 420,000 acres has been alienated under permanent title in the Federated Malay States for planting, and of this about two-thirds or 280,000 acres are available for rubber cultivation, and the remaining 140,000 acres for coconuts. It is reasonable to suppose that a large proportion of this alienated land will be planted in the course of the next few years in view of the fact that it represents a considerable capital expenditure for premium paid, annual rent and survey fees already disbursed.

The number of small holdings of under one acre belonging to Chinese settlers and Malays is a remarkable feature. They amount to many thousands, but in the aggregate do not comprise 1½ per cent. of the total rubber acreage.

POSSIBILITIES FOR EXPANSION.

In addition to the land alienated in the Federated Malay States for agricultural purposes there is in Johore, Kedah, Kelantan and Trengganu a

* NOTE.—An article on this subject, published in the *Malay Times* in March, 1912, gives the area as 550 acres at the end of 1911.

very large area suitable for rubber cultivation. The extent of this acreage cannot be gauged with any degree of accuracy, as the lands in question have not been surveyed; but it embraces several million acres, and of this probably not less than 15 per cent. will be available for plantation purposes. In Johore the percentage is certainly higher than 15 per cent. In point of fact the question of suitable land will not check extensions for many years to come, especially in the case of established estates with reserves of forest lands, for with the existing organisation the cost of additional development will be comparatively low. The real hindrance to future expansion will arise from a fall in the value of rubber, an increase in the wage rate of coolies, or a shortage of labour for work other than tapping and attending to the general necessities of plantations already existing.

TENURE OF LAND.

Conditions for acquiring land for agricultural purposes differ in various States and the Settlements. In Perak, Selangor and Negri Sembilan for land exceeding ten acres in extent a premium of \$3 per acre is paid if with frontage to a public road, and \$2 per acre if without such frontage. The rent may be fixed by the Resident with a minimum of \$1 per acre per annum for the first 6 years and thereafter at \$4 per acre per annum for first-class lands, and \$3 per acre per annum for second-class lands. For lallang (grass) lands no premium is paid, but no difference is made in the annual rent. For lands planted with coconuts, fruit trees or rice a rebate can be obtained reducing the annual rent to \$2 per acre per annum, but no such reduction is granted for rubber plantations.

In Pahang the annual rent per acre for the first six years is 50 cents per acre and thereafter \$2 per acre per annum.

These provisions apply to all lands alienated in the Federated Malay States since the 19th of January, 1906.

In the native States of Johore, Kedah, Kelantan, Perlis and Trengganu land grants are obtained from the Sultans on constantly varying terms. As these States will undoubtedly come into the Federation in the near future the tenure of land will become similar to that applied in the present Federated States.

In the Straits Settlements, comprising Singapore, Malacca, Dindings Province Wellesley and Penang, the premium on agricultural lands is \$3 per acre. An annual rent of 50 cents per acre is charged for the first six years, and thenceforth \$3 per acre. No difference is made between lallang (grass lands and forest.

In many cases existing estates are held under conditions ruling before the present land regulations came into force in the Federated Malay States or the Straits Settlements. Some properties are freehold, or they pay only a small quit rent, while others are subject to a revision of the rent charge at the end of 30 years; but the majority of the plantations are now held under the terms I have stated.

The following charges are made on agricultural lands granted in the Federated Malay States :—

	\$
1. Preparation of grant	2.00
2. Survey Fees for 100 acres	135.00
For each additional acre up to 300 acres ... ..	.90
Survey Fees for 300 acres	315.00
For each additional acre up to 1,000 acres ... ..	.80
Survey Fees for 500 acres	475.00
For each additional acre up to 1,000 acres ... ..	.70

	\$
Survey Fees for 1,000 acres	825.00
For each additional acre up to 2,000 acres ... ..	.60
Survey Fees for 2,000 acres	1,425.00
For each additional acre up to 4,000 acres ... ..	.50
Survey Fees for 4,000 acres	2,425.00
For each additional acre up to 5,000 acres ... ..	.40
Survey Fees for 6,000 acres	3,225.00
For each additional acre up to 10,000 acres ... ..	.30
Survey Fees for 10,000 acres	4,425.00
For each additional acre above 10,000 acres ... ..	.20
3. Registration of Grant	1.00
4. Certificate of Title	2.00

The charges and fees in the Straits Settlements are practically similar and need not be repeated, especially in view of the fact that the remaining area of land available for rubber plantations is extremely limited. In the four native States of Johore, Kedah, Kelantan and Trengganu the same scale will be applied as soon as they are included in the Federation.

TAXATION.

In the Straits Settlements the method of taxing rubber varies. In Malacca there is an assessment tax on rubber trees of 6 years old and upwards of 7 cents per tree, the rate varying from time to time, but fixed at that amount for 1912. It is not an easy tax to collect, especially in the case of Chinese and native holdings, but was imposed in this form in order to avoid any portion of the revenue becoming liable to contribution towards national defence as is the case with all revenue from Customs duties. In Penang a tax not exceeding 5 per cent. on the profits of an estate is exacted.

In the Federated Malay States an export duty of $2\frac{1}{2}$ per cent. *ad valorem* is collected on all shipments of rubber, and the revenue so derived is employed for the maintenance of roads and other public works.

The general revenue of the Straits Settlements and the Federated Malay States is derived from export duties on tin and tin ores, agricultural, miscellaneous and forest products, licences to sell and manufacture opium (chandu) and for the sale of alcoholic liquors and other purposes, premium and rent on lands alienated for agricultural and mining operations, revenue from Posts and Telegraphs, profits from State railways and import duties on intoxicating liquors.

ELEVATION ABOVE SEA LEVEL.

The elevation of the rubber estates may be divided into four sections: (1) Old sugar lands near the sea-board situated about four feet above sea level; (2) lands formerly cultivated with tapioca and other products and having an elevation of from 10 to 50 feet; (3) old coffee estates lying some 50 to 150 feet above sea level; and (4) forest lands opened up during the past seven years with an elevation of 100 to 300 feet. Above 300 feet practically no rubber cultivation has been attempted as yet, but there are several experimental stations in the Federated Malay States where Pará rubber is being grown at elevations varying up to 2,000 feet in order to ascertain the value of the high-lands for its production.

SOIL.

The three characteristic varieties of soil in the rubber growing districts of Malay are:—(1) A strong grey clayey loam in the low lands near the sea-board where sugar-cane was formerly cultivated, and where the water level is

only some 4 to 5 feet from the surface; (2) a hard laterite soil preponderating in Malacca, in some of the southern sections of Negri Sembilan, and appearing in some portions of Selangor and Perak; (3) a deep, red loam over a laterite subsoil found over a great extent of Negri Sembilan, Selangor and Perak. The Pará rubber tree flourishes in all three of these soils. In the first the root-growth is chiefly lateral, the tap-root disappearing when the water level is reached. Sluice gates are necessary on these lands to prevent inundations from high tides. The trees mature early and yield well, but are subject to damage from strong winds on account of the absence of tap-root. In the laterite soils the growth is slower and the yield of latex smaller during the first two or three years of tapping, but trees from 10 to 12 years yield more freely proportionately than at the earlier stages, and show little difference to those grown on the grey loam of the low lands near the seaboard and river estuaries. The third soil extending to the foothills of the mountain ranges in Negri Sembilan, Selangor and Perak is, in the opinion of impartial experts, best adapted to the cultivation of the Pará rubber tree. The growth is rapid in the earlier stages, and the tree sends down a deep tap-root which gives a firm hold for resistance to strong winds. Occasionally these trees are snapped off by a violent gust, but seldom thrown down. The trees grow evenly and mature well, give a satisfactory return of latex from four years upwards, and show steadily increasing yield with additional age. There are large areas of this red loam soil in Johore, Pahang, Kelantan and Kedah, and it will undoubtedly be preferred by practical planters in the future development of estates in the Malay Peninsula. The objection to it is that on steep hillsides it washes badly in heavy rains on account of its friable nature, and even with drainage scientifically applied there is great difficulty in saving the topsoil, especially when an estate is clean weeded in the earlier stages of its development.

RAINFALL.

Throughout the Federated Malay States the rainfall varies greatly, and is influenced by the proximity of different localities to the mountain ranges in the centre of the Peninsula. The following records for seven years ending 1910 show the distribution:—

Place.	Period.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total	
Perak.	Taiping ...	16.93	16.16	17.00	18.46	12.00	9.00	7.67	9.81	9.03	18.23	18.45	14.27	167.01	
	Kuala Kangsar	9.06	5.98	5.61	7.88	7.00	4.65	4.25	6.54	5.20	12.38	9.49	8.04	85.98	
	Batu Gajah ...	11.34	6.53	8.34	10.64	7.08	5.08	4.83	7.13	6.66	10.25	10.03	11.12	99.03	
	Telok Anson ...	10.96	9.06	6.65	10.08	7.44	6.30	3.94	5.80	6.87	9.63	9.04	11.69	97.46	
	Tapah ...	13.32	9.09	11.64	11.24	11.55	8.36	7.46	8.43	9.91	15.47	13.89	12.09	132.55	
	Lenggong ...	1910	5.98	13.47	7.59	10.89	4.63	9.93	2.22	5.46	3.99	13.44	7.13	9.57	94.30
Selangor.	Kuala Lumpur	1904-1910	6.33	7.27	9.12	9.86	8.20	5.69	4.21	5.08	5.81	9.47	6.41	11.43	89.93
	Klang ...	"	7.11	7.00	6.16	7.96	9.06	4.06	4.20	5.27	5.49	7.06	8.39	13.7	85.73
	Kuala Langat...	"	6.89	4.82	3.03	5.31	5.50	3.57	5.78	6.81	5.69	8.40	9.66	11.91	77.37
	Ulu Langat ...	"	6.29	7.56	9.01	9.05	8.49	4.64	4.07	7.11	6.61	9.82	8.54	10.78	91.97
	Kuala Selangor	"	7.80	5.22	4.69	4.40	4.46	4.31	4.71	4.62	5.27	9.08	7.94	9.89	72.39
	Kuala Kubu ...	"	12.14	6.80	9.51	12.06	10.49	9.32	7.31	10.71	10.55	15.41	13.39	9.60	127.29
Negri Sembilan.	Seremban ...	1894-1910	5.47	5.82	8.18	9.79	7.58	6.27	4.81	5.11	5.28	10.49	8.19	8.96	85.95
	Jelebu...	"	4.44	3.64	7.34	6.43	6.24	4.45	4.40	4.45	4.68	6.38	8.29	7.63	68.17
	Kuala Pilah ...	"	6.00	5.04	5.05	5.02	5.47	4.64	3.59	4.18	4.32	7.80	7.86	3.70	70.67
	Tampin ...	"	4.63	4.71	6.29	8.32	7.08	5.12	5.70	6.55	5.80	8.39	9.04	7.18	79.31
	Coast (beri-beri)	"	4.89	3.92	3.70	7.10	6.63	7.00	7.72	9.30	8.11	11.07	9.85	7.56	86.85
	" town hospl.	1909-1910	5.00	5.78	3.20	8.59	5.18	4.61	6.52	15.42	6.15	9.91	6.42	6.55	83.33
	Mantin ...	1907-1909	3.18	6.02	8.44	10.79	5.20	6.94	4.83	6.15	5.74	8.33	8.18	7.73	81.53
Pahang.	Lipis ...	1906-1910	9.06	7.06	6.08	5.45	7.39	10.30	8.64	9.59	6.71	9.67	10.82	11.05	101.82
	Raub ...	"	9.92	6.81	5.43	5.65	5.20	7.16	4.28	5.59	6.87	9.30	8.67	9.39	84.27
	Bentong ...	"	10.74	6.78	10.13	6.77	6.04	6.97	3.57	4.96	6.03	10.39	7.72	11.68	91.18
	Pekan ...	"	18.55	15.06	7.91	6.58	8.81	6.48	4.71	5.45	9.28	10.53	15.13	41.00	149.49
	Kuantan ...	"	15.10	11.22	6.48	5.78	4.75	4.74	5.69	5.91	7.36	11.57	12.53	33.27	124.40

January and February, 1912, were exceptionally dry months, rain falling on very few days during that period. This drought did not diminish the yield of latex to any very great extent as far as the Commissioners were able to judge, although complaints to that effect were heard not infrequently.

TEMPERATURE.

Throughout the Malay Peninsula a very even temperature prevails in the lowlands. The following gives the average mean maximum and minimum returns for fifteen years from 1896 to 1910 :—

				PERAK.		
				Maximum.	Minimum.	
	Taiping	...	...	90·52	...	72·21
	Batu Gajah	...	...	90·58	...	72·46
	Ipoh	...	...	90·30	...	72·63
	Telok Anson	...	...	89·89	...	70·88
	Tapah	...	...	90·22	...	69·16
	Parit Buntar	...	...	89·38	...	72·66
				SELANGOR.		
	Kuala Lumpur	...	...	89·90	...	71·30
	Klang	...	...	86·80	...	71·80
	Kadjang	...	...	87·00	...	74·40
	Kuala Selangor	...	...	86·80	...	76·00
	Kuala Kubu	...	...	89·80	...	72·40
				NEGRI SEMBILAN.		
	Seremban	...	...	88·40	...	69·20
				PAHANG.		
1910 only.	Kuala Lipis	...	...	92·80	...	68·70
	Raub	...	...	92·00	...	64·00
	Pekan	...	...	89·60	...	71·90
	Bentong	...	...	92·00	...	66·00

ORIGIN OF THE MALAY RUBBER INDUSTRY.

The rubber industry in the Malay Peninsula originated from plants sent from Kew Gardens in 1877, and its establishment was mainly due to the persistent efforts of Mr. Henry N. Ridley, the late Director of the Botanical Gardens at Singapore, who induced a few planters to give the new cultivation a trial. It was not until 1898 that any serious attention was paid to rubber growing, and only then because coffee and sugar-cane planting became unremunerative. Then estates were interplanted with Pará trees, and many tapioca plantations, owned in great part by Chinamen, were treated in the same way. It was not until 1905 that the true value of Pará rubber plantations was appreciated and understood. Since that date the area has increased from some 40,000 acres to the extent of 650,000 acres. It says much for the hardy character of the *Hevea Brasiliensis* that this development has taken place, for very little attention or care was given to the trees in the early stages of the industry, and even when large areas were opened up a great lack of knowledge existed in regard to methods of cultivation and treatment. Evidence of this is seen everywhere on the older estates where trees are crowded together without any regard to adequate space for future development, and also in the damage done when tapping was begun. It is only within the last three years that planters generally realized the mistakes that had been made, and the necessity of careful and methodical cultivation and treatment to ensure successful results.

It is not understood generally that the seed collected in 1876 by Mr. Wickham on the banks of the River Tapajos in the Amazon Valley was all from the white species of the *Hevea Brasiliensis*. This variety is considered in Brazil to be much inferior to the black species growing principally on the Rivers Madeira, Purus, Juruá, the Acre territory and in Bolivia. It is

claimed that the latex from the black *Hevea* gives a rubber greatly superior in resiliency to that extracted from the white variety. The only estate in the Orient on which I found the black species was at Pasir Oeting, near Bandoeng, in Java, where 200 trees imported through Paris were in a flourishing condition.

HEALTH OF RUBBER TREES.

After visiting the principal centres of the rubber planting industry the conclusion reached is that healthy conditions are the rule. The usual diseases exist, but not in an aggravated form.

Fomes is thoroughly understood, and when found is immediately treated. White ants are attacked as soon as they appear. "Die-back" rarely does much damage. The worst pest brought to the notice of the Commissioners was the formation of burrs or nodules in the bark. While these do not materially affect the health of the tree they are a serious interference to tapping. They occur principally on old trees that have been badly tapped in past years, but they are found also on trees that have never been tapped. Dr. Huber considers that they are the result of suppressed bud expansion combined with bad tapping, and this diagnosis is supported by Mr. Lewton Brain, the Director of Agriculture at Kuala Lumpur. Dr. Huber further thinks they may be induced by the action of sun on renewed bark causing an irritation. It is worthy of note that in the Amazon Valley where the trees have been hacked about to a merciless extent by the use of the small axe (*machadinho*) these nodules are practically unknown. In the earlier stages of growth these burrs can be removed without damage to the cambium, but if neglected they spread and unite with the wood of the tree. Taking a broad view, however, of this and other pests, and even of the bad tapping in past years the actual proportion of trees affected does not exceed 2 per cent., and probably if an accurate census was taken would be found to be much below that figure.

GENERAL CONDITIONS IN CONNECTION WITH THE VALUE OF MALAY RUBBER PLANTATIONS.

In any consideration of the value of rubber estates in the Malay Peninsula it is necessary to divide them into three distinct groups. These are: (1) Estates that were established up to 1908 by private enterprise or joint stock companies, and previous to the great rubber "boom" of 1909-10; (2) Estates purchased by joint stock companies in 1909-10 from group number 1, and new estates opened up during the "boom" period; (3) Estates established during 1911-12 by public companies or private enterprise. The first of these groups originally comprised about 250,000 acres, and consisted principally of coffee, sugar and tapioca estates converted into rubber properties by interplanting existing crops with *Pará* rubber trees. They were owned partly by British capital and partly by Chinamen resident in the Malay Peninsula. The original capitalisation was small, and the cost of interplanting with rubber exceptionally low. When the rubber boom occurred some two-thirds of these properties were purchased at high prices by joint stock companies formed in Europe, Shanghai, Hongkong and Singapore. The remaining area of this group, containing approximately 80,000 acres, continued working and producing on their original low capital basis, and they naturally succeeded in paying very high dividends. Among these are Bukit Rajah, Cicely, Federated Selangor, Inch Kenneth, Linggi, Pataling, Selangor, Vallambrosa and many others.

Group number 2 comprises some 500,000 acres owned by joint stock companies formed chiefly during 1909 and 1910, and consists of estates purchased from group number 1 at boom prices, and of new plantations opened in 1909, 1910 and 1911. This group must be regarded as decidedly over-capitalised in relation to the necessary cost per acre for bringing plantations to the yielding stage. The third group consists of companies and individuals who have opened new plantations on a conservative basis under careful and

experienced management, and propose to limit the total expenditure up to the time the trees are yielding to a sum of from £25 to £30 per acre. Under these conditions some 70,000 acres are comprised. In connection with this group are to be found many practical planters and successful estate managers who are opening up properties for their own account at the present time.

Briefly summed up the position is that if £30 per acre is taken as the actual necessary basis of cost for bringing an estate to the dividend paying stage, and it will be shown presently in this memorandum that this should be the case, the groups may be classified as follows:—

	Acres.
1. Old established estates working on original capital of less than £30 per acre	80,000
2. Companies formed during the "boom" with high capitalisation	500,000
3. New plantations limited to a capital expenditure of from £25 to £30 per acre	70,000
	<hr style="border-top: 1px solid black;"/>
	650,000
	<hr style="border-top: 3px double black;"/>

OVER-CAPITALISATION AND ITS EFFECTS ON THE RUBBER INDUSTRY OF THE MALAY PENINSULA.

The first effect of over-capitalisation at present noticeable is a marked inclination on the part of many estates to extend the area under cultivation on economical principles, and so reduce the capital charge per acre. With the price of rubber at 4s. per pound or thereabouts it is possible that the necessary money may be forthcoming to enable these extensions to be effected, but with any great fall in the value of the raw material the raising of fresh capital will become more and more difficult. It is only natural to suppose that a certain proportion of the rubber companies launched during the "boom" will be subject to the usual vicissitudes of any great industry, and meet with unforeseen contingencies requiring substantial financial assistance to overcome. Failing such aid a deadlock must ensue, and the liquidation of a number of these concerns will follow. In cases where debentures have been issued the assumption is that the holders of these securities will foreclose and obtain possession of the property at a low capital basis. Where no fixed charges exist the estates will be absorbed by more fortunate companies or purchased at a comparatively low cost by European, Chinese or local capitalists. There does not appear to be any likelihood of such estates going out of cultivation unless very exceptional circumstances occur. I think it is safe to assume that the effect of over-capitalisation will be towards the extension of the present cultivated area, and the consolidation of properties into larger holdings generally.

As an indication of the amount of over-capitalisation resulting from the rubber boom of 1909-10 it is necessary to refer to the value of the flotations made in those years, in Europe, Hongkong, Shanghai and locally. I cannot give the exact figures, but the approximate amount, certainly on the cautious side, may be taken as:—

British—Subscribed in 1909-10-11	£24,000,000
Local and Chinese do.	3,000,000
	<hr style="border-top: 1px solid black;"/>
	£27,000,000
	<hr style="border-top: 3px double black;"/>

This gives an average capitalisation of £54 per acre distributed over 500,000 acres comprised in group number 2. Groups numbers 1 and 3 may be capitalised at £4,000,000, or an average of £27 per acre.

From 1907 to the end of 1911, the nominal capital of rubber companies floated in London for all countries was £74,122,325.

COST OF OPENING AND BRINGING INTO BEARING AN ESTATE OF 1,000 ACRES FULLY EQUIPPED WITH PERMANENT BUILDINGS, FACTORY, AND MACHINERY—CLEAN WEEDING THROUGHOUT AND PLANTED 150 TREES TO AN ACRE.

In opening an estate on forest land not less than 50 feet above sea level the estimated cost includes all necessary charges up to the end of the fourth year, when the yield should be sufficient to allow the capital account to be closed. Felling and cleaning up after the burning of the timber is done by contract. Weeding may be by contract or day labour accordingly as the Manager considers the cheaper method. Prices vary slightly according to the situation of the estate, and whether it is close to or distant from the native labour employed for felling and clearing. I have not allowed for the removal of the stumps of trees or big logs, as the great majority of practical planters I have consulted do not consider the possible benefit by diminishing the probability of disease is compensated for by the extra expense entailed, and they prefer to maintain a vigilant look-out for fomes, white ants and other pests, and treat individual cases as they occur. The following distribution of costs is self-explanatory:—

	\$
1. Premium on land—1,000 acres	3,000
2. Survey fees, etc.	1,000
3. Rent for 4 years	4,000
4. Felling, clearing and burning	15,000
5. Cleaning up after burning	7,500
6. Weeding—1st 9 months	18,000
„ 2nd year	12,000
„ 3rd year	9,000
„ 4th year	5,000
7. Draining	5,000
8. Roads and bridges	7,500
9. Holing, lining and filling	4,000
10. Planting and supplying	2,000
11. 200,000 plants 2 years old	4,000
12. Manager's bungalow, \$6,000 } Assistants' „, \$4,000 }	10,000
13. Factory and machinery	25,000
14. Lines for coolies	20,000
15. Tools	10,000
16. Management	50,000
17. Hospital, medical attendance, etc.	15,000
18. Contingencies	8,000
Total ...	<u>\$235,000</u>

This is equal to £27. 8s. 4d. per acre.

The cost of opening up lallang (grass) land is practically the same as forest. There is no premium on this land, but the expenditure for eradicating the lallang is very heavy. On forest land the total for felling, cleaning and weeding for 4 years amounts to \$66 $\frac{50}{100}$ per acre; on lallang land the cost is \$45 for cleaning and \$24 per acre for weeding for 4 years, or a total of \$69. Some planters are inclined to prefer lallang land because it is free from stumps and timber; against this is the fact that it has been under cultivation at some former period, and has lost a large proportion of its topsoil.

If the land to be opened up is low-lying and swampy, the cost of extra draining will be, approximately, £3. per acre.

COST OF MAINTENANCE OF A PLANTATION OF 1,000 ACRES OF
6 YEAR OLD TREES 150 TO THE ACRE FOR ONE YEAR.

The following estimate has been compiled after most careful enquiry :—

	\$	
1. Rent	4,000.	
2. Collecting	75,000.	(Includes depreciation on all tools and materials.)
3. Curing and preparation ...	14,000.	(Allows 20% depreciation on factory and machinery).
4. 2½% duty on 300,000 pounds rubber	7,500.	
5. Transport, shipping charges and commission ...	6,000.	
6. Management	17,500.	(Allows for Manager, 2 Assistants and 2 clerks).
7. Hospital and Medical attendance	6,000.	(In conjunction with neighbouring estates.)
8. Weeding	3,500.	
9. Maintenance roads and drains	3,500.	
10. Cultivation	6,000.	
11. Contingencies	7,000.	
12. Depreciation of buildings other than factory ...	5,250.	
	\$155,250.	

With a yield of 300 pounds of rubber to the acre the cost would be 51½ cents or 14½ pence per pound f.o.b. at port of shipment. At present costs of production are higher than I have stated, but in all cases I have examined this has been in connection with trees of unequal ages, many of them yielding for the first time, and therefore more expensive to tap and collect; or estates have been allowed to become overgrown with lallang and weeds, and thus entailed a heavy additional expenditure charged against revenue. Therefore I consider my estimate a fair one for an estate of 1,000 acres planted with 150 trees to the acre and properly cared for from the commencement. As the trees grow older and the yield increases, the costs of tapping and collecting per pound of rubber should diminish substantially, as should also be the case in somewhat lesser proportion with the other items of expenditure. At the present rate of costs from port of shipment in the Malay Peninsula to date of sale in London or Liverpool a sum of 3½ pence per pound of rubber must be added to the aforesaid cost of production, and this will bring the total costs per pound to one shilling and sixpence sterling. If the price of rubber drops 2s. per pound the *ad valorem* charges for duty, commissions and brokerage will be proportionately reduced, and the total cost up to date of sale would be, approximately 1s. 4½d., leaving a net profit to the producer of 7½d. per pound of rubber.

I have taken the yield of an estate properly cared for as being 300 pounds of dry rubber per acre at 6 years old, but as is shown later on in this memorandum, the indication is that 6 year old trees frequently give a greater return than 2 pounds per tree. I think, however, it is better to be on the safe side. The quality of the rubber made in the various factories, whether crepe or sheet, is distinctly good, although the colour is not quite so bright as the Ceylon product, probably on account of the discoloured water common to the Peninsula. The percentage of first latex and lump is low, and so far as I have seen only averages 70 per cent., while scrap, bark-scrap and earth scrap amount to

30 per cent. In a few cases such as at Kamuning, the return was 82 per cent. first latex and lump, and 18 per cent. scrap, bark-scrap and earth scrap. There is a ready sale in Singapore and Penang for the produce of the estates, but as a rule a margin is allowed for commission. In Ceylon the reverse obtains, and the relative price in Colombo is frequently higher than London, and for this reason a small proportion of Malay rubber has been shipped to Colombo for sale during the last two years.

MANAGEMENT OF ESTATES.

The Managers of the Malay estates are nearly all men of trained experience and good education. Many of them came to the country 20 years ago and learnt their work as planters on the coffee and sugar plantations, and then helped to convert those properties into rubber estates. Others have been recruited from Ceylon and Southern India, and several resigned the Government service for planting. All are required to be efficient in the handling of labour and the organisation of the routine work of estates. They are responsible in every way for the well-being of the estates and their personnel, and it is seldom that any serious fault is found with their administration abilities. When the rubber boom was at its height the demand for Managers and assistants was so great that a certain number of incompetent men obtained employment, but they are fast being weeded out. Over the Managers are the Visiting Agents appointed by companies and private owners to inspect estates from time to time, examine tapping and other work, and advise on the general policy to be followed in connection with the administration.

EQUIPMENT OF FACTORIES AND THE PREPARATION OF RUBBER.

It is only on a comparatively small proportion of the Malay rubber estates that factories specially designed and equipped for the curing and preparation of rubber existed until recently. Old coffee stores and sugar houses were utilised, and temporary buildings erected for the treatment of the latex, drying and smoking. Hand machines were used for creping and rolling out sheets. In fact, most primitive methods were customary on the great majority of plantations. During the last two years, however, a complete change has occurred, and modern machinery driven by Tangye, Diesel, Hornsby, Blackstone, Crossley, and many other types of engines has been, or is being, installed on all estates of any importance. Hitherto many estate managers have preferred to send their latex to a neighbouring factory for treatment, but as greater areas of trees begin to yield it is found more economical and satisfactory to undertake the curing and preparation at the source of production rather than to pay for the work being done outside. On many large estates where the fields are far distant from the central station, coagulating stations are established, and the latex coagulated before being sent to the factory.

The expense of a modern factory is comparatively light apart from the cost of the building. It is, as a general rule, steel framed with corrugated iron roof and sides. Concrete floors are laid down with adequate guttering to allow free drainage for constant sluicing and washing, for cleanliness is a necessity in the preparation of the latex. On one side of the factory are installed the machines for washing, creping or rolling sheets, and these are driven from overhead or underneath shafting served by engines of the type already mentioned. The machines most in use are the Shaw or the Bridge patent, and are of three grades for breaking down the latex, rolling and finishing. Opposite the machines are the coagulating jars or tanks; if the former they are made of glazed earthenware, and if the latter lined with glazed tiles and built in oblong form. Coagulation is effected by the use of acetic, formic or fluoric acid. Down the middle of the building are tables for handling the coagulated latex before it reaches the machines, and for the crepe or sheet after passing through them. Where sheet is made it is coagulated in flat pans 15 inches long, 10 inches wide, and 2 inches deep, and in these the latex is

allowed to set for some hours before machining. The fuel for generating the necessary engine power varies; liquid fuel, suction gas and anthracite being employed, the latter being most commonly used at present. At Caledonia I saw a washing machine for scrap of the Werner, Pfleiderer and Perkins patent at work and giving excellent results.

From the factory creped rubber is taken to the drying sheds and hung for a period varying from 12 to 20 days until the moisture has evaporated, the time required for this operation being dependent very largely on weather conditions. Sheet rubber is taken from the factory to the smoking house and remains for 4 to 5 days in smoke produced by burning cocoanut husks or wood. It is then removed to the drying shed and hung until fit for packing. Scrap, bark scrap and earth scrap are made into crepe and dried in the same manner as first latex and lump. In the Malay Peninsula the practice of smoking crepe has been abandoned on the majority of estates, and a light, bright colour is the object desired. In this connection the water supply occasions many difficulties on account of its muddy and discoloured character, and it is frequently necessary to filter it before use in the creping and washing machines. Another result of this condition of the water supply is the heavy wear and tear on the rollers of the machines on account of grit.

On only one estate visited were mechanical dryers in use. On three plantations, Kent, Wardiebrun and Bukit Rajah, Passberg vacuum dryers have been erected, but the managers had received orders from London not to make use of them. It is difficult to understand this policy, as the results obtained from these machines in Ceylon are distinctly satisfactory, and the saving in labour and economy in time of undeniable advantage. With a dryer the latex can be ready for shipment 24 hours after its delivery at the factory and, moreover, the expense of drying sheds is avoided. Many managers state that artificial drying must be adopted very shortly in view of the rapidly increasing output in the factories.

When dry the rubber is packed in wooden boxes and despatched to the port of shipment. The cases in use are the "Venesta," imported from Russia, the "Momi" from Japan, and various kinds manufactured from native woods. The weight of rubber in these boxes varies on different estates from 112 lbs. net to 230 lbs. net. In all cases the ton weight far exceeds the 50 cubic feet measurement allowed by the Shipping Convention, for which the charge is 65s. from Singapore or Penang to London or Liverpool or the Continent of Europe, and 75s. from elsewhere in the Peninsula to those ports.

In connection with this high charge for freight some experiments are now being made for pressing the rubber in presses similar to those used in Sumatra for tobacco, and then baling in Javanese mats. By this method something more than a ton weight of rubber can be shipped in the 50 cubic feet allowed by the Shipping Convention, and a saving in the freight charge of nearly one halfpenny per pound effected. There is little doubt that if the trial shipments in this form are successful, boxes will be discarded for bales.

NUMBERS AND NATIONALITY OF LABOURERS EMPLOYED ON THE ESTATES.

Official returns for 1910 show that the labour force, not including contractors to fell and clean up new estates, at the end of that year was :—

		Tamils.	Javanese. Malays. Chinese. Others.				Total.	
M. 74,966	}	98,988	M. 13,003	17,760	14,258	45,663	2,361	179,030
F. 24,022			F. 4,757					

The returns for 1911 have not yet been published, but the Superintendent of Indian Immigration has supplied me with the following data :—The total number of deck passengers from India in 1911 was 101,218 adults and 7,253 minors, making 108,471 in all; of these 78,376 adults and 6,013 minors were sent to plantations, and of the remaining 24,082, who had paid their own

passages from India, no record was kept, but the majority probably went to different estates. The number of coolies returning to India in 1911, was 48,103, thus leaving a balance in favour of Malay of 60,268. From these figures the Indian coolies working on estates or on public works may be placed at not less than 150,000 at the present time. Recruiting in India is being carried out actively, and only a few days ago 300 men, despatched from various estates, left for India for recruiting purposes. The Superintendent of Indian Immigration informed me that he fully expected a large increase in the number of Tamil coolies during 1912.

The method of recruiting Indian coolies for work on the Malay rubber estates is best explained by the following notice handed to me by the Superintendent of Indian Immigration for the Malay Peninsula :—

THE TAMIL IMMIGRATION FUND AND ITS WORKING.

For years previous to 1907 there had been continual complaints from employers importing Tamil labour that coolies imported by them were attracted away to the service of other employers who paid no portion of the expense of importation.

The Immigration Committee, appointed by the Government in that Year, recommended that the cost of the importation of Tamil labourers should be distributed amongst all those who employed them ; and the Tamil Immigration Fund Enactment based on the recommendations of the Committee was subsequently passed.

Under this law an assessment on the amount of work done by their coolies is levied upon all employers of Tamil labour, and the proceeds are paid into a fund styled the Immigration Fund. Employers are required to send in to the Superintendent of Immigrants, Penang, on printed forms which may be obtained from him, certified returns of their Tamil labour for every quarter ; the returns must be sent during the months of April, July, October and January.

The amounts at which they are then assessed must be forwarded to the Superintendent to be credited to the Immigration Fund. This fund is not part of the general revenue of the Government. It is administered by the Superintendent of Immigrants under the authority of the Immigration Committee solely in the interests of importers of Tamil labour. The Government is in fact the largest contributor to the Fund through the assessments which it pays on all Tamil coolies employed in the Railway and in the Public Works Department.

The purposes for which the Fund can be used are expressly laid down in the Enactment, as follows :—

(a) The payment of free passages for Tamil labourers and their families from the Madras Presidency to this country.

(b) The general expenses incurred in connection with the recruiting of labour in the Madras Presidency.

The Government bears all the expenses of administering the Fund, paying the salaries of officials and clerks ; maintains large Kanganies camps at Madras and Negapatam where coolies recruited by Kanganies are housed pending shipment by steamer ; provides officials in India (the Emigration Agent at Madras and the Superintendent of Emigration Depot at Negapatam) who superintend these camps and generally assist in matters connected with recruiting ; provides coolie depots at Penang and Port Swettenham ; and grants a large annual subsidy to the Steamship Company which maintains the weekly coolie service from India to the Straits.

The Immigration Committee pay from the Fund passage money from India and trainage in India as explained below and also maintain native Agents (at present 11 in number) in India at various places whose duties are to assist Kanganies, help in forwarding their coolies, and arrange the payment of their train fares.

Whenever the balance to the credit of the Fund after paying the above expenses justifies such a course, a recruiting allowance is paid to employers in respect of each coolie imported by them from India under the Committee's licences. At one time an allowance of \$3 per head was paid and this was subsequently increased to \$4.50. The number of coolies imported in the summer of 1910 was, however, so large and the bills for steamer tickets consequently so high that the Immigration Fund became temporarily depleted. As the assessment on the increasing number of Tamils now in the country is received the Fund will again have a balance to dispose of but at the time of writing (November, 1910) it has been necessary to suspend for the present the payment of recruiting allowances. The allowance will, however, be renewed as soon as possible.

It will be seen that practically all the money collected from employers in the form of assessment goes back directly or indirectly to those employers who import labour; the only portion that does not do so being the small amount paid in connection with the native Agents appointed at various places in India.

INSTRUCTIONS FOR RECRUITING BY KANGANIES IN INDIA.

Kanganies receive licences to recruit in the Madras Presidency from the Superintendent of Immigrants, Penang. The licences are granted free of charge.

Forms, to be filled in by the employer, will be sent on application to the Superintendent of Immigrants; when the required details have been filled in by the employer, the licences should be sent to the Superintendent of Immigrants for registration and signature.

The usual procedure is as follows:—

The employer sends his Kangany over to India and generally makes arrangements with either the Madura Company, in Negapatam, or Messrs. Binny and Company, in Madras (these firms are the British India Steamship Company's Agents in each case), to finance him; the custom is for the firm to pay the Kangany so much per head for each coolie actually produced by him and shipped.

By this system the risk is avoided of giving to the Kangany large advances in cash which he might very likely squander. These two firms have Agents in the Straits and Federated Malay States to whom they cable every shipment the number of coolies shipped for each Estate; the local Agents inform the employers, and it is thus possible for each Estate Manager to know before arrival of the steamer the number of coolies shipped for him.

There are officers of this Department stationed at Negapatam and Madras; at the former he is styled Superintendent of the Emigration Depôt, and at the latter Emigration Agent. They give assistance and advice to Kanganies, and they superintend the Kangany camps at Negapatam and Madras respectively, where coolies are accommodated until the shipment.

The Kanganies holding registered licences will be granted:—

- (a) The train fares of coolies from various centres in the Madras Presidency to Negapatam or Madras.
- (b) The steamer fares of coolies from Negapatam or Madras to Penang or Port Swettenham.

The train fares in India are paid to the Kanganies themselves in India by the Committee's Agents in India. The system in which they are paid is simple and works easily and is explained to every Kangany on his arrival in India.

The steamer fares are paid direct to the Steamship Company by the Committee's Agents in India and all coolies for shipment must be brought to the Kangany camps at Negapatam and Madras and shipped from thence by the contract steamers to Penang or Port Swettenham.

All Tamil coolies are entitled to leave their employer after a month's notice whether they are imported from India or recruited locally, and no deductions may be made from their wages for any sums advanced them or expended in their recruitment before their arrival at their place of employment.

L. H. CLAYTON,

Superintendent of Immigrants, S.S. & F.M.S. :

PENANG, 24th NOVEMBER, 1910.

Employers of Tamils are assessed at the rate of \$8 per Coolie for 1912. If coolies are taken on locally, and not through the Immigration Department, an additional assessment of \$4 per head is imposed, the object being to stop the crimping of coolies from other estates. Out of the funds so obtained free passages are provided from the recruiting districts in Southern India to the estate in the Malay Peninsula. Hitherto, a rebate has been allowed to estates sending their own Kanganies to the recruiting districts, but this has been suspended for the present.

Javanese labourers are divided into two classes:—(1) Those imported under indentures to serve on estates for a period of three years and (2) those recruited locally as day labourers without any time contracts. The inden-

tured Javanese are obtained through agents in Java and under conditions imposed by the Javanese Government. I attach a copy of the approved contract showing the responsibilities of both parties to the agreement. The cost of recruiting and importing these coolies varied from \$92 to \$97 per head in 1911, and is a most serious consideration for many employers. The advantages of a permanent labour force must be set against this high initial expenditure. Endeavours are now being made to reduce the cost of importation and arrange for a more plentiful supply, and a commission with this purpose in view was despatched to Java recently to approach the Government on the subject.

The Javanese recruited locally in the Malay Peninsula are labourers who have come to the country in past years and not cared to return to their homes. They do not form a large proportion of the estate labourers.

The following is the form of agreement between labourers and employers approved by the Javanese Government:—

LABOUR AGREEMENT.

As per Government Resolution dated 28th February, 1894, No. 5 (Supplement No. 4964, juncto No. 5826 and 7073). The recruiting is permitted by Government resolution, dated

We, the undersigned:

<i>Register No.</i>	<i>Running No.</i>	<i>Name.</i>	<i>Age.</i>	<i>Origin.</i>	<i>Last Residence.</i>	<i>Remarks.</i>
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Contractors on the one side	and	
Soesman's Emigratie Vendu en Commissie Kantoor, acting in this instance as the Attorneys of		situated

Contractors on the other side
hereby declare to have mutually agreed as follows:

1. The Contractors on the one side undertake to perform the following work on behalf of the estate of

FOR MEN.

Field and manufactory labour, in connection with the cultivation of rubber, sugar, coffee and tobacco, laying out watercourses (gutters) and roads should they be able to do so, building sheds and houses, carpentering which requires more skill excepted, felling forests, performing the duty of a carter and rendering assistance in case of danger caused by fire or water, in short all such labour as generally performed by natives.

FOR WOMEN.

Cleaning the seedlings' beds and gardens, cleaning buildings and premises and performing all such work as can be done by and demanded from women.

2. The extent of the labour to be performed on behalf of the estate is at most (nine) hours on every working day, provided always that the Contractors on the one side shall not work for more than six hours at a stretch. Only under exceptional circumstances the Contractors on the one side may be required to work for more than nine hours. In such cases and in case the Contractors on the one side out of their own free will perform labour beyond the working time, extra wages will be paid to them on the first pay-day, such wages to be calculated per hour and under the condition that such extra payment shall be at least 50% more than the contracted wages per hour.

3. The Contractors on the other side shall pay to the party on the one side daily wages of 25 dollar cents to a man and 15 dollar cents to a woman, to be settled on or before the 15th of the month during which the wages are earned. The wages shall also be paid for the days during which labour is not performed owing to inability beyond the labourer's fault. In case of sickness not caused by misbehaviour half wages shall be granted for only one-tenth of the contracted period. No wages are due for the rest and holidays mentioned in this agreement. Deductions from the contracted wages are only allowed for settling advances or debts due to the Contractors on the other side.

4. The Contractors on the one side acknowledge having received an advance of F. 15 for each unmarried person and F. 20 for each married couple, which advances shall be paid off in monthly instalments not exceeding two dollars each.

5. The Contractors on the one side are free from labour during one day of every week and during two days on the occasion of the native New Year.

6. The Contractors on the other side supply to the Contractors on the one side, as well as to their family, free lodging, free medical attendance, free board and free drink-water.

The free board shall consist of:—Raw rice $1\frac{1}{2}$ lbs., spice 1 oz., tamarind 1 oz., fish (fresh or salted) 6 oz., salt 1 oz., onions 1 oz., vegetables 6 oz., coconut oil $\frac{1}{2}$ oz., fresh coconut, blachan 1 oz., green pepper 1 oz. Children, whether doing any work or not shall receive the following rations:—

Children between 12 and 15 years, full ration.					
„	„	10	„	12	„
„	„	3	„	10	„
					$\frac{3}{4}$
					$\frac{1}{3}$

The free board is furnished for the days when work is done for those days which the labourers may count as working days and for the holidays as per agreement.

7. The labourers shall not be separated from their family against their will.

8. Contractors on the other side shall pay the passage money for conveying the labourers and their family, if any, to their destination, and at the termination of the contracted period or in the event of the agreement being dissolved by *force majeure* convey them back to their residences free of charges. In case the contract is renewed the labourers and their families shall be entitled to a free passage to their respective homes, this right holding good for 5 years after the lapse of the last contract. Should a labourer die in the course of his service time the Contractors on the other side shall for their account send back the family to their original residences within 3 months after the decease if desired and keep them pending a shipping opportunity.

9. The time vested by the Contractors on the one side on account of the consequences of a misbehaviour, sickness during more than one-tenth of the contracted period, leave, desertion or punishment in jail shall not be counted as a part of the contracted time.

10. At the expiration of any agreement Contractors on the other side shall at their expense send home the labourers and their families and keep them pending shipping opportunity.

11. Any agreement lapsed and any renewal of contract must be reported to the Dutch Consul at Singapore. The Contractors on the other side must also report to the above Consul whether any of the released labourers have renewed the agreement or whether they have been sent home, and if so by what opportunity, or whether they have settled down somewhere else.

12. The Contractors on the one side shall present themselves to the Manager of the Estate on the _____ day of the month _____ of the year 19 _____

13. This Agreement has been made to hold good for from date of presentation to the Manager.

Thus agreed at Samarang on this date the _____ day of the month _____

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The Contractor on the other side after having explained the above mentioned to the Contractors on the other side and to the Contractors on the one side in their language and after they have agreed to the above mentioned and the Contractors on the one side have declared that the above conditions are well known to them and that they accept these conditions, the advance of F. 2.00 for the unmarried and F. 5 for the married are paid in my presence while another F. 2.50 to the unmarried and F. 5 to the married shall be paid before embarkation and the remaining F. 10 at Singapore, in presence of the Dutch Consul, to which they agreed.

Samarang, the _____

19 .

THE RECRUITING COMMISSIONER.

Malays do not constitute a large section of the estate labour. They do excellent work in felling timber and opening up land on contract, but care little for the steady drudgery of day to day work throughout the year. They

are not very numerous in the planting districts except in Kelantan where the development of the rubber industry is only beginning, and there they are employed to a considerable extent.

Next to the Tamils the most important factor in the labour supply is the Chinese. The class known as Singkeh is indentured for one year and agrees to perform 300 days' work. The men receive only 8 cents per day as pay, but must be provided with rations and other articles costing 20 cents per day. The cost of recruiting these men and bringing them to the estates is, approximately, \$60 per head. Notwithstanding this high charge the average cost for the day's wage would be reasonable if it was not for the heavy percentage of desertions, frequently amounting to 25 per cent. of the total force. The tin-mining industry attracts these men so strongly that they cannot resist the temptation of breaking their contract for agricultural labour in order to take their chance in the mining districts. In this respect conditions have become so unsatisfactory of late years that I am assured by the Protector of Chinese in Penang that this class of indentured labour will not be permitted after the present year.

The majority of the Chinese labourers on estates are free from any indenture. They are a most valuable addition to the labour force, but they demand high wages and in some special cases are paid as much as 90 cents a day. They do better work on contract than for a daily wage, and in this manner are employed with most satisfactory results on many estates for tapping, weeding and all other labour which can be contracted out on reasonable terms.

According to the last Census taken on March 10th, 1911, the total population of the Malay Peninsula was 2,649,970, divided as follows:—

		Males.		Females.		Total.
Europeans	..	7,875	...	3,190	...	11,065
Eurasians	...	5,296	...	5,511	...	10,807
Malays...	...	720,110	...	692,086	...	1,412,196
Chinese...	...	734,384	...	181,499	...	915,883
Indians...	...	204,220	...	62,950	...	267,170
Others ...	...	16,481	...	16,368	...	32,849

WAGE RATE ON RUBBER ESTATES.

The indentured Javanese and the Singkeh (Chinese) labourers are the only estate labour receiving fixed remuneration under contract. The former are paid at the rate of 25 cents a day for men and 15 cents for women. With the cost of rations added this means the equivalent of 40 cents for men and 26 cents for women per diem, plus \$92, the cost of importation—distributed over three years, and a sum of \$5—for repatriation. This brings the actual value of a day's work to 54 cents for men and 40 cents for women.

The Singkeh (Chinese) indentured labourer receives 8 cents per day—\$6 per month food allowance, and costs \$60 per head to import. For this consideration he works for 300 days in the year, and his average daily cost is 52 cents. As experience shows that some 25 per cent. of these men desert the average cost per head at the termination of the year's contract is seldom less than 60 cents per head per day.

The Tamil coolie is free to obtain such daily wages as he can bargain for, but the rate varies in every district and often on neighbouring estates. On an old established and popular estate, such as Linggi, the average rate for men is 27 cents and 22 cents for women. Tappers receive 30 cents and 25 cents. On Devon Estate only 30 miles distant men are paid 45 cents and women 35, with higher rates for tappers. In the Klang district the average rate paid is 30 cents for men and 25 for women, with 33 cents and 28 cents for

tappers. In fact the rate paid depends very largely on the management of the estate and the reputation it has in Southern India. Taking an average over a number of estates employing Tamil labour in the Federated Malay States and the Straits Settlements, I am of opinion the daily rate would be, approximately, 38 to 40 cents for men and 33 to 35 for women, including the amount of the assessment for the Indian Immigration Fund.

Malay labourers receive 45 cents for men and 35 for women as a general rule. Occasionally higher rates are paid when the demand for labour is urgent.

Chinese labourers ask a higher wage than any other nationality. It varies from 60 cents to 90 cents per day, and in some cases even a dollar has been paid. When calculating contract work the usual custom is to allow 60 cents per day per man, and at this rate arrangements can be made for nearly all classes of estate work, whether tapping, weeding, roading or draining. Many Managers prefer to work with Chinese contractors rather than day work with Tamils or Javanese, and assure me that the tasks are better and more expeditiously accomplished.

During the last two or three years the demand for labour has been very keen on account of the great area being opened up in new plantations, and there has been a decided tendency towards a rise in the rate of wages. For the present, however, prices appear to have reached as high a scale as they are likely to average for some years to come unless a second "boom" occurs and unexpectedly large additions should be made to the area under cultivation. The satisfactory annual increase in the importation of Tamil labour is an important factor in keeping down the wage rate, especially in regard to the Chinese. If for any reason Tamil immigration should decline and the estate owners become dependent on Chinamen there is small doubt that increased wages would result.

HOURS OF WORK.

A day's work is nominally nine hours, but the distribution is by task, which coolies can finish by 2 p.m. and often at an earlier hour. In the factories work continues until the day's delivery of latex has been put through the machines, and special rates are paid to the men detailed for this purpose.

SKILLED AND UNSKILLED LABOUR.

The only skilled labour required on an estate is for tapping and factory work. Intelligent coolies learn both very quickly under competent supervision. On a plantation where all trees are yielding latex at least 80 per cent. of the men, women and children will be employed at tapping and collecting. For factory work specially intelligent men are selected, but the whole process of the curing and preparation of rubber is so simple that there is seldom any difficulty in connection with the labour employed. Cleanliness is one of the principal factors, and is dependent on supervision.

HEALTH CONDITIONS.

Health conditions vary very greatly throughout the Malay Peninsula, but the three principal diseases found in more or less degree in all districts are Malaria, Dysentery and Diarrhoea. The deaths amongst Indian coolies from the former in 1910 numbered 2,597 and from Dysentery 1,350, while 683 were due to Diarrhoea.

Sanitary regulations are now enforced on all estates by Government ordinance. Adequate hospital accommodation must be provided under proper medical attendance and supervision, and the hospitals are constantly visited

by official medical officers. The cost of the erection and equipment of the estate hospitals is a serious item of expenditure, but in the case of smaller properties it is not uncommon for an arrangement to be made to contribute to the cost of a joint hospital situated in a central position and to pay *pro rata* of the coolies employed in order to defray the expenses of the resident doctor and the maintenance of the wards. Naturally planters grumble a good deal at the strict medical inspection practised by the authorities; but it is obviously necessary to enforce all possible measures for the health of the labourers, both on account of the loss of work occasioned by sickness and also to maintain a good reputation for the Malay plantations in the districts of Southern India where the coolies are recruited.

ORGANIZATION OF A RUBBER ESTATE.

The organization of a rubber estate in the Malay Peninsula offers no very serious difficulties to an experienced planter. If Government forest land is required an application for the area in question must be submitted to the authorities, and this application will be attended to without undue delay. The land is then surveyed and the fees charged according to the scale set out in the Land Enactment Act. If the area chosen lies low and near the water level, under conditions such as exist in sections in Malacca, Klang, Teluk Anson, Province Wellesley and other districts, it must be drained before the timber is felled, otherwise the débris after felling and lopping will not burn. On the undulating forest lands away from the seaboard this draining work is unnecessary.

Contractors for felling and cleaning the requisite acreage are obtained without difficulty, Malay labour doing this work most effectively at a cost of from \$12 to \$15 per acre for felling and lopping and \$7.50 per acre for the subsequent cleaning up. After the burn has taken place the work of lining and holing is carried out, the holes being cut two feet in diameter and two feet deep. If the estate is to be clean-weeded the planter will have arranged for weeding by contract or day labour to begin shortly after the burn, and he must purchase the necessary plants if he has not made his own nurseries the previous year. Before the planting season comes the holes will have been filled in. Planting takes place in all months, but October and November are regarded as most suitable on account of prevailing weather conditions.

The distance apart for planting Pará rubber varies so much that no hard and fast rule can be laid down. Close planting means a greater yield of latex during the first few years the trees are under tapping, but the wider apart they are the better their development becomes after the first 7 or 8 years. Gradually the custom is being established of planting 20 feet by 15 feet (150 trees to the acre) 20 feet by 20 feet (108 trees to the acre) 30 feet by 10 feet or 36 feet by 12 feet, the two latter systems termed in Malaya "Avenue Planting." Considerations of land and general conditions must influence any decision as to the distance.

CATCH CROPS.

The planting of catch crops is condemned almost universally in Malaya. A few estates still continue the practice, but the opinion of the great majority of planters is distinctly adverse to it on the grounds that it seriously retards the development of young rubber trees. Tapioca is the principal catch crop grown by both Europeans and Chinese when rubber estates are opened in this manner. Robusta coffee is found in certain districts and in Province Wellesley sugar is still cultivated. One effect of any catch crop is to produce an uneven growth in young plantations and this adds considerably to the cost of tapping when the trees begin to mature.

As showing how detrimental sugar cane grown as a catch crop proves to be, I attach a return furnished to me by the General Manager of the Penang

Sugar Estates Company. The young trees were grown for two years interplanted with cane, and their yield at 7 and 8 years old is far below the average :—

CALEDONIA ESTATE,
1st March, 1912.

DEAR MR. AKERS,

I now send you further yields from Yarvi Section for 1911 :—

Field.	Acres.	Planted.	Per tree. Hs.	Per acre. Hs.
4	150	1903 and 1904	2·17	227
6	68	1904 and 1905	2·53	265
7	152	1904 and 1905	2·20	239
Chankat Dain	52	1904 and 1905	2·55	270

These trees are planted on the average 20 ft. by 20 ft., or, say, 108 to the acre.

Yours sincerely,
C. E. DUNCAN.

In the colony of Singapore and in the south of the State of Johore a considerable amount of rubber is interplanted with pineapples as a catch crop. I estimate this area as not less than 12,000 acres for the Island of Singapore and 10,000 for Johore. The reason for interplanting in this manner is that a pineapple canning industry has been established in Singapore for some years past and proved to be a profitable enterprise. From a rubber planter's point of view nothing can be said in favour of pineapples as a catch crop; they exhaust the soil of both nitrogen and phosphates and the serrated edges of the leaves occasion constant damage to the bark on the lower portion of the stems of the rubber trees. One can well understand, however, the attractions of this cultivation for the Chinese agriculturists, who are the people principally interested in it. Within a few months of planting a remunerative crop is obtained and this profitable return continues for some three years with no other expenses than keeping the ground free from weeds and picking the fruit when ripe. Moreover, the fruiting season extends practically over the whole year and so causes no inconvenience in the addition or reduction of the labour force employed.

Tapping begins when the trees have attained a girth of 18 inches at 3 feet from the base, and as a rule in Malaya this development occurs when they are about three and a half years of age. In three or four days after the first tapping the latex should run freely. The yield is not great during the first year of tapping, generally about $\frac{1}{2}$ lb. to $\frac{3}{4}$ lb. per tree, and the cost of collection is high. So far as I have been able to judge, provided the tapping is well done with a single V at the base, no damage is occasioned to the trees by beginning at this early age. In fact they appear to gain in girth when compared to trees left untapped. Throughout Malaya the Jebong or Burgess knife, which is the farrier's knife with very slight modifications, is preferred to any of the more modern implements. After tapping for two years with the single V on alternate sides, the tree is divided into quarters above the V tapping and is then tapped on the half herring bone system. This allows four years for the renovation of the bark, and in the opinion of most of the practical planters I have met this period is sufficient for the purpose. The cups used are glass, porcelain, aluminium, or other metal, but the two former are in general use owing to the high cost of aluminium.

By the end of the fourth year, when the estate is yielding evenly throughout, the planter will have thoroughly established his methods of work and his connections in Southern India for recruiting purposes if he employs Tamil labour. Similarly, if he prefers Chinese or Javanese coolies he will have made his arrangements in the proper quarters and should have no serious difficulty in regard to his annual labour requirements. During the first four years of an estate the bungalows, lines for coolies, factory and other buildings should have

been erected in accordance with the scale laid down in the estimate already given for the cost of opening up a plantation. The method of the curing and preparation of rubber is given under the description of factories and need not be repeated.

On estates with trees averaging six to eight years old a good tapper will look after 300 trees, tapping daily with three cuts to the tree, collecting the scrap, washing the cups and delivering the latex and scrap at the factory. On some estates the average is 400 trees per day with three cuts. On one estate visited the average was 420 trees with three cuts per tree. On the majority of estates daily tapping is the rule, but on quite a large number the trees are tapped on alternate days only. Many different opinions are expressed as to the class of labourer most efficient for tapping. On the various estates visited equally good and bad tapping was being done by Tamils, Javanese, Chinese and Malays. The best work was invariably found where the most competent supervision existed, and I think it is safe to say that the general standard of tapping on an estate depends on the attention and care devoted to the superintendence of the work by the manager and his assistants.

ESTATE BUILDINGS.

The Governments of the Straits Settlements and the Federated Malay States insist that housing accommodation for estate labourers shall be constructed in accordance with specified requirements in regard to space and elevation of floors above the ground. The usual type of lines now erected are built on brick pillars with an open air space 4 feet high below the flooring. Steel or hardwood framing is used, with galvanized iron or attap thatch roofing. The sides are of galvanized iron or hardwood, and a plank flooring is provided. As a rule a six-foot verandah is constructed on both sides of the building. The rooms are generally 12 feet by 10 feet to accommodate 4 coolies: but on a few estates the size is 10 feet by 8 feet, and in these 2 coolies are housed. Proper drainage is necessary round the lines and the regulations require that adequate latrines be erected. The cost of these lines varies considerably in accordance with the material employed in construction, but the price may be taken, approximately, at \$100 to \$150 per room of 12 feet by 10 feet. Ample hospital accommodation is required with separate wards for men and women, and equipped with a dispensary, cook-house and other necessary adjuncts. The wards are furnished with beds fitted with mosquito nets and they are supplied generally with all modern sanitary requirements.

Bungalows on estates may be expensive or economical according to the ideas of the planter, but I have seen several thoroughly serviceable plantation houses with accommodation for two persons, built at a cost of from \$5,000 to \$6,000, and these fulfil all requirements on a young estate.

DISCIPLINE ON ESTATES.

On the estates the discipline depends on the tact and common sense of the manager and his assistants. Tamils are tractable and give little trouble when justly treated. Chinese are more difficult and are best handled through their own headmen, and the same remark applies to Javanese. As a general rule there is very little serious trouble with estate labourers; but recently the Chinese have been unsettled by the events taking place in their own country, and they have shown a turbulent spirit on several estates and in various towns in the Malay Peninsula.

DIETARY.

Rice forms the principal food of all classes of coolies working on estates in Malaya. In addition, the diet comprises dried fish, cocoanut oil, curry stuffs, fruit and vegetables. Meat of any kind is a luxury and not an article of everyday diet. Rice is supplied at cost price to all estate coolies, and below cost when prices are unduly high.

EDUCATION.

No efforts are made to provide any sort of schools for the children of estate coolies. In the villages there are public schools for native children taught in the vernacular, but none for those of Chinese or Indian parentage.

YIELD OF RUBBER TREES.

It has not been an easy task to obtain accurate returns of the yield per acre of rubber plantations, for the reason that on every estate visited the ages of trees varied and only in comparatively few instances have separate records been kept for different fields. I have, however, collected reliable data from 20 estates scattered throughout the Federated Malay States and the Straits Settlements, and from those returns the approximate yield can be very clearly defined. The returns show :—

<i>Age of Tree.</i>	<i>Number of Acres.</i>		<i>Yield per Acre.</i>	
				Lbs.
4 to 5 years	...	3,814	...	188
5 to 6 "	...	5,266	...	306
6 to 7 "	...	3,973	...	349
7 to 12 "	...	7,438	...	501½

I do not know of any more efficient method of calculating the yield than by dividing production by the number of acres. Of course it would be more satisfactory if a larger acreage could be taken, but to secure this result nothing short of an estate to estate visitation would serve, and in the great majority of cases the enquiry would be barren of any useful result for lack of definite records on the estates.

<i>Estates.</i>	<i>Acres.</i>	<i>Age.</i>	<i>Trees to Acre.</i>	<i>Yield per Acre.</i>	<i>Locality.</i>
1. Wardieburn...	400	4	150	105	(Kuala Lumpur) SELANGOR
"	400	5	150	316	
"	400	6	150	435	
"	400	7	150	460	
"	15	5¼	120	230	
"	15	12	130	1,339	MALACCA
2. Kumendore ...	1,200	4	150	110	
"	1,200	5	150	230	
"	1,200	6	150	320	
"	1,200	7	150	470	
3. Bernham Perak	135	4	200	150	(Teluk Anson) PERAK
4. Nova Scotia...	1,600	4½	150	273	Do. do.
5. Changkat Salak	300	4	150	173	(Kuala Kangaar) PERAK
6. Kent...	89	4½	150	250	(Kuala Lumpur) SELANGOR
7. Lauderdale ...	300	5½	160	350	(Taiping) PERAK
"	100	4½	180	242	
8. Pegoh	651	5½	150	323	MALACCA
9. Kamuning ...	38	8½	150	650	(Sungei Siput) PERAK
"	600	5½	150	500	
10. Bukit Rajah...	1,200	8½	150	650	(Klang) SELANGOR
11. Belmont	700	7	150	437	(Kajang) SELANGOR
12. Vallambrosa...	1,517	8	150	391	(Klang) SELANGOR
13. Linggi	600	8	150	520	(Seremban) NEGRI SEMBILAN
14. Rubana	1,100	7½	161	563	(Teluk Anson) PERAK
15. Labu...	1,350	6	150	437	(Labu) NEGRI SEMBILAN
16. Cicely	139	11	150	900	(Teluk Anson) PERAK
"	700	5½	150	375	
17. Gedong	2,000	5	150	314	" "
			180		
18. Tali Ayer ...	1,023	6	121	234	" "
			161		
19. Caledonia ...	29	11	240	780	PROVINCE WELLESLEY
20. Caledonia (Krian) ...	400	7	130	375	" "

COST OF PRODUCTION ON 40 ESTATES IN 1909.

Furnished by Messrs. KENNEDY & Co., Agents and Stockbrokers, Penang.

Company.	Year.	Crop Rubber.	Inclusive Cost.	
		Lbs. dry.	Per lb.	F.o.b.
Anglo-Malay	1909	517,550	—	10·68d.
Batu Caves	1909	45,769	2s.	4·23d.
Bukit Rajah	1909-10	314,778	1s.	4·31d.
Carey United	1909-10	107,194	1s.	5·77d.
Cicely	1909-10	85,280	1s.	3·18d.
Consolidated Malay	1909	215,893	1s.	11·22d.
Damansara	1909	202,440	1s.	9·00d.
Federated Malay	1909-10	293,066	Fcs. 2·60 =	2/0·68
Federated (Selangor)	1909-10	101,444	1s.	4·41d.
Golconda	1909	96,260	1s.	10·54d.
Golden Hope	1909	51,420	1s.	4·91d.
Highlands and Lowlands... ..	1909	346,259	1s.	1·03d.
Inch Kenneth	1909-10	127,677	2s.	2·36d.
Jugra Estate	1909-10	60,017	2s.	4·38d.
Kamuning... ..	1909-10	67,046	1s.	6·41d.
Kuala Lumpur	1909-10	489,807	1s.	7·40d.
Labu	1909	86,763	2s.	0·72d.
Lanadron	1909	249,247	1s.	2·94d.
Ledbury	1909	56,881	2s.	3·76d.
Linggi	1909	545,219	1s.	1·48d.
London Asiatic	1909	75,427	2s.	1·68d.
Mabira Forest	1909	82,424	3s.	5·03d.
Malacca	1909	236,969	2s.	0·21d.
North Hummock	1909-10	47,994	1s.	6·76d.
P.P.K.	1909	45,474	2s.	4·15d.
Pataling	1909	152,090	1s.	0·62d.
Perak	1909-10	115,895	1s.	2·19d.
Sagga	1909-10	49,534	3s.	4·25d.
Seafield	1909	43,746	2s.	3·18d.
Sekong	1909-10	41,178	3s.	6·72d.
Selangor	1909	326,654	1s.	1·58d.
Seremban	1909a	124,021	1s.	9·14d.
Shelford	1909	33,097	2s.	7·60d.
Singapore Para	1909-10	60,437	1s.	7·77d.
Straits (Bertam)	1909-10	99,697	1s.	2·64d.
Sumatra Para	1909-10	122,248	2s.	0·73d.
Sungei Kapar	1909	114,970	1s.	6·16d.
United Serdang	1909-10	67,828	2s.	2·24d.
Vallambrosa	1909-10	371,316	1s.	2·83d.
Yam Seng... ..	1909-10	49,937	2s.	4·07d.

This shows an average cost of 22·17 pence per pound in 1909, as compared to 17·27 pence per pound in 1911.

COST OF PRODUCTION IN 1911.

To ascertain further the cost of production f.o.b. at Singapore, Penang or Port Swettenham I have taken the returns of 22 representative estates scattered throughout the Straits Settlements and the Federated Malay States. I know from careful investigation on these estates that the proportionate adjustment of expenses to revenue and capital accounts has been made, although there is almost invariably an inclination to charge more to revenue and less to capital when any doubt exists on the subject.

The average cost of production on the 22 estates selected was 17·27 pence in 1911, f.o.b. The distribution of these charges was approximately :—

	Cents.	
1. Collection	31	Includes cost of implements, cups, etc., and proportion depreciation on buildings.
2. Curing and preparation	4	Includes depreciation on machinery and factory.
3. Weeding	5	} Includes proportion depreciation on buildings.
4. Cultivation and roads and drains	5	
5. Management	7	Includes depreciation on bungalows and all salaries.
6. Hospitals, etc.	4	Includes salary of Doctor and all expenses.
7. Transport	50	
8. Commissions	50	
9. Shipping Charges	50	
10. Rent	2	
11. Export duty or assessment	2·50	
Total	<u>62</u>	cents. = 1s. 5¼d. per pound of dry rubber.

1911.

COSTS F.O.B. PORT SWETTENHAM, PENANG OR SINGAPORE.

Estates.	Pence.	Locality.
1. London Asiatic	16	Malacca and Selangor.
2. Kamuning	15	Perak.
3. Anglo-Malay	13	Selangor and Negri Sembilan.
4. Linggi	14½	Negri Sembilan.
5. Labu	17½	Negri Sembilan.
6. Kuala Lumpur	20	Selangor.
7. Pegoh	22	Malacca.
8. West Country	19	Selangor.
9. Ayer Panas	21	Malacca.
10. Kumendore	16	Malacca.
11. Bukit Rajah	10½	Selangor.
12. Vallambrosa... ..	12	Selangor.
13. Cicely	12	Perak.
14. Changkat Salak	15	Perak.
15. Nova Scotia... ..	20	Perak.
16. Lauderdale	14	Perak.
17. Godong (Straits Rubber Co.)	14½	Perak.
18. Caledonia	26	Perak.
19. Rubana	21½	Perak.
20. Tali Ayer	16	Perak.
21. Batak Rabbit... ..	20	Perak.
22. Nai Kee	25	Perak.

The average from the foregoing figures is 17·27 pence per pound of rubber f.o.b. ; but for January and February last the costs at Cedong were at the rate of 38 cents per pound, equal to 11 pence sterling and several others show substantial decreases in the first two months of 1912.

I have discussed this question of costs at length with such practical and successful planters as Mr. E. B. Skinner, of Kuala Lumpur, Mr. Wm. Duncan of the Penang Sugar Estates, Mr. Power, the General Manager of Linggi Plantations, Mr. Maurice Maude, of Cicely Estate, Mr. Wakefield, of Bukit Rajah, and Mr. Howard, of Vallambrosa. All these authorities are agreed that there will be a substantial reduction in costs when a larger acreage comes into bearing and trees average a greater age. Indeed, Mr. Skinner and Mr. Duncan are strongly of opinion that a marked decrease will be shown in 1912. The ultimate minimum average cost for the next five years should be 1 shilling (42½ cents) per pound of rubber f.o.b., distributed as follows, and with the same conditions regarding depreciation, etc., as in 1911 :—

	Cents.
1. Collecting and tapping	20
2. Curing and preparation for market	4
3. Weeding	2
4. Cultivation and roads and drains	2
5. Management	5
6. Hospital, etc.	2
7. Transport... ..	½
8. Commissions	½
9. Shipping charges	½
10. Rent	1
11. Contingencies	2½
12. Export Duty or Assessment	2½
TOTAL ...	42½

Equal to 1 shilling per pound of dry rubber f.o.b. Port Swettenham, Penang or Singapore.

ANALYSIS OF EXPENDITURE.

From the average cost of production in 1911 and from the estimate of ultimate minimum cost it will be seen that the principal expenditure is for the collection of latex, weeding and cultivation—all items dependent on the wage rates. I have already pointed out that the cost of collection of latex should decrease rapidly as the trees become older and the yield greater. So also weeding will become cheaper as the trees give more shade—indeed when the trees on the estate average 8 years old the cost of weeding should be reduced to almost a negligible quantity, as the work will consist only of a general cleaning up once or twice a year. Cultivation will remain to some extent a permanent charge, as pruning of trees, treatment of diseases, and manuring will be necessary for old trees. The remaining items must be considered as permanent recurring charges, with the exception of the value of the export duty which will vary with the fluctuations in the price of rubber. Of course I refer only to estates worked on the principles in force to-day. With great amalgamations of groups of estates it may be possible to reduce expenditure to a much lower level.

CHARGES FROM PORT OF SHIPMENT TO DATE OF SALE.

The present scale of charges from the Malay Peninsula to London or Liverpool are shown in the following table. The freight under the last shipping

Convention is fixed at 65/- for 50 cubic feet from Singapore or Penang and 75/- from other ports. As the cost of local transport to Singapore or Penang by coasting vessels or railroad practically brings the cost to 75/- for the great majority of the planting districts I have taken that figure as a general rate. Commissions are calculated on the basis of a selling value of 4s. 2d. per pound and would of course rise or fall with any fluctuation in prices :—

	Pence.
1. Freight	·75 per pound.
2. Rebate to buyer	
2½ per cent. and ½ per cent. draft	1·50 „ „
3. Brokerage	·25 „ „
4. Sales, charges, insurance, storage and sundries	·75 „ „
5. Merchants' commission	·50 „ „
	<hr/>
TOTAL	3·75 „ „
	<hr/>

Shipments to Antwerp work out at about one penny per pound cheaper on account of the smaller rebates to buyers; similar conditions, though not quite to the same extent, occur in connection with Hamburg.

TOTAL AVERAGE COST PER POUND OF RUBBER SOLD IN LONDON OR LIVERPOOL IN 1911.

The average cost per pound f.o.b. Malay Peninsula in 1911 was 17·27 pence. The cost from port of shipment to London or Liverpool was 3¾ pence and allowance must also be made for London and other headquarter office expenses, directors' fees, percentage of preliminary expenses incurred in the formation of companies, income tax and other items. In the circumstances it is safe to conclude that the total average cost of production for every pound of rubber sold in London during 1911 was not less than 22 pence sterling.

That the cost of production in the immediate future will be reduced substantially may be regarded as assured. In the next 3 or 4 years the average cost f.o.b. in Malaya should not exceed 1/- per pound. A saving of one half-penny per pound can be effected by shipping in Java mat bales in place of boxes, thus reducing cost of freight and packing. A fall in the price of rubber to 2/- per pound would signify at least one penny less in London commissions. It would also mean a reduction in the value of the export duty of nearly one penny per pound. Taking these facts into consideration the average cost per pound up to time of sale should not exceed 13·25 pence plus the London office charges for directors' fees, etc., if the value drops to 2/- per pound for fine plantation rubber.

PAST AND FUTURE PRODUCTION.

In calculating future production I think the most satisfactory method is to take the present cultivated area of 650,000 acres and allow for it a yield based on the averages already given. In 1919, the trees comprised in the present total acreage will be of an average age of from 10 to 11 years. The average yield from 7,438 acres situated in different sections of Malaya from trees of 7 years upwards was shown to be 501½ pounds of rubber per acre. Taking the average yield of 10 year old trees at 4 hundredweights per acre, the total yield in 1919 would be 130,000 tons. Young trees planted after 1912 will add considerably to the output, but it is safer to allow this extra yield to compensate for any section of the existing area which may from unforeseen circumstances fall below the estimated yield of 4 hundredweights to the acre.

The following table gives the actual and estimated output from 1906 to 1919 :—

Year.	Acreage yielding.						Output in Tons.
1906	9,600	...	...	430
1907	10,800	...	...	485
1908	24,300	...	...	1,629
1909	37,400	...	...	3,340
1910	66,200	...	...	6,504
1911	95,800	...	...	10,700
				(Estimated).			
1912	180,000	...	...	21,000
1913	241,000	...	...	36,000
1914	292,000	...	...	43,800
1915	362,000	...	...	63,300
1916	538,000	...	...	80,700
1917	650,000	...	...	97,500
1918	650,000	...	...	113,750
1919	650,000	...	...	130,000

This estimated return is calculated as far as possible on the ages of trees in bearing. I have allowed 260 lbs. per acre for trees averaging 6 years old in 1912, 3 hundredweights for 7 year old trees in 1913 and 1914, $3\frac{1}{2}$ hundredweights for an average of 8 years in 1915, 3 hundredweights for 1916 and 1917 on account of the large number of young trees coming into bearing, $3\frac{1}{2}$ hundredweights for an average age of 9 years in 1918, and 4 hundredweights for an average of 10 years in 1919.

THE FUTURE DEVELOPMENT OF THE MALAY RUBBER ESTATES.

To forecast the future of the Malayan rubber industry is not within the province of this memorandum, but all indications are that within the next decade many radical changes will occur in the methods of administration and constitution of the estates. A forest of rubber trees will extend from Penang to Singapore, and to work this great area economically and successfully will entail its treatment as a forest proposition in place of a system of comparatively small plantations. It may be that great corporations will be formed to buy up vested interests from companies or individuals owning rubber properties to-day; or possibly it may be that the State will assume control. In either case the forests will not be worked by small holders on account of the expense of such a system. To produce cheaply it will be necessary to grant concessions for collecting the latex on the basis of a royalty on the amount of rubber produced. In all probability these concessions would be split up into sub-contracts to Chinese headmen who would undertake to pay a certain fixed price for their privileges in addition to a royalty, and also to provide sufficient labour to ensure the collection of a specified minimum of latex. Regulations for the protection of the trees and penalties for damage from bad tapping or other careless treatment will have to be enforced by the employment of forest rangers employed by the Corporations, or by the Government if the industry passes under its control.

SINGAPORE, 21st March, 1912.

THE RUBBER INDUSTRY
IN
SUMATRA, DUTCH EAST INDIES.

CURRENCY UNIT: 1 GILDER = 20 PENCE.

REPORT ON THE RUBBER INDUSTRY IN SUMATRA.

LOCALITY.

The Commissioners visited the principal rubber growing districts of Sumatra. These lie on the East Coast of the Island and include the districts of Langkat, Deli, Serdang, Padang, Batoe Bahra, Asahan and Bila. A few estates have been opened in other sections of the Country, but difficulties of transport have prevented any extensive cultivation outside the districts mentioned. Roads and Railways are in course of construction, or projected, to link up the existing cultivated areas and to give access to forest lands hitherto lying idle, but some years must elapse before these projects materialise, for the Dutch Colonial Government is slow to move in such matters and requires very substantial proof of the necessity and financial value of such undertakings before becoming in any way responsible for them. It is for this reason that the rubber planting industry has been practically confined in the past to the districts where coffee and tobacco estates were established many years ago and transport already existed, or to certain sections along the Bila River where communication by water is available.

AREA OF RUBBER ESTATES.

Statistics regarding the extent of cultivated rubber in Sumatra vary considerably, and no official return is made of the acreage or number of trees. A handbook published in Medan places the area at 126,000 acres in 1911, but qualifies this by stating that details of many plantations are omitted. A census furnished to me by the Nederlandsche Handel Maatschappij gives the number of trees in 1911 as 16,733,470, or approximately, 167,000 acres.

The Secretary of the Planters Association of Sumatra informed me that the returns in 1911, on which subscriptions were based, showed about 145,000 acres under cultivation, but that these did not include isolated estates on the West Coast or any Chinese or Malayan holdings. In the circumstances I consider the returns of the Nederlandsche Handel Maatschappij much the most reliable on account of the facilities appertaining to that very important Corporation for acquiring accurate information and, therefore, I accept the estimate of 160,000 acres as being a conservative calculation of the area under cultivation in December, 1911. So far as my enquiries go the additional acreage ready for planting during the present year (1912) is not less than 60,000 acres, of which 55,000 lie in the districts on the East Coast and 5,000 in the South-Eastern and Western sections of the Island. Many planters assure me that this figure of 60,000 acres for 1912 is too low, but I cannot obtain confirmation of any greater area.

The following table shows the expansion of the rubber planting industry during the past seven years :—

	Year.		Area under cultivation.		Increase.
			Acres.		Acres.
	1906	...	6,140	...	—
	1907	...	20,150	...	14,010
	1908	...	38,800	...	19,650
	1909	...	67,000	...	28,200
shows effect of	}	1910	100,000	...	33,000
rubber boom of		1911	160,000	...	60,000
1910-11.		1912	220,000	...	60,000

The ficus trees, of which 351,000 were planted previous to 1909, are not included in the above figures as they are being cut out on the majority of the estates. The holdings of Malays and of Chinese settlers are numerous, but of very limited extent and in the aggregate are only a small proportion of the total acreage.

During the last three years the tendency has been to open larger plantations than formerly, a notable case in point being the Holland-American Company at Asahan where 13,000 acres have been planted in the last two years and further extensions are now being made to bring the total area under cultivation to 30,000 acres.

POSSIBILITIES FOR EXPANSION.

The amount of land available for the extension of rubber planting in Sumatra must be counted by millions of acres, for two-thirds of the Island remain untouched to-day. But other considerations besides suitable land must play a most important part in the future development of the industry. The question of the labour supply enters largely into the problem, and although at present no complaint is heard of any scarcity on the estates the demand will be substantially increased as the existing young plantations reach the tapping stage. Then, again, means of communication require great additions and improvements before the necessary foreign capital will be attracted for the extension of the industry to the forest lands of the interior. It is more probable that expansion in the near future will take place along the banks of navigable rivers or in the localities hitherto reserved for growing tobacco. It is in this latter direction that a rapid development is possible. For many years Deli has been the centre of the tobacco industry, and to the East and West an area of some 400,000 acres has been devoted to tobacco cultivation. After one, or at most two, crops have been gathered the land is allowed to lie fallow for seven years before being replanted, and so 400,000 acres in reality only means 50,000 acres of cultivation. In the present circumstances the inclination to plant rubber trees after the tobacco crop is harvested is a tempting proposition. Practically no expense is involved beyond keeping the land clean to allow the trees to come to maturity. If any substantial drop in the value of tobacco occurs there is small doubt that a very considerable portion of these tobacco lands will be converted into rubber estates.

TENURE OF LAND.

Land is held in Sumatra under long leases from the native Sultans, these Concessions being approved by the Dutch Colonial Authorities. As a rule the terms of holding are not less than fifty and not exceeding one hundred years. The rental varies, but is generally at the rate of one guilder (20 pence sterling) for each bouw, equal to one and three-quarters English acres. These land grants comprised a large acreage when they were obtained for tobacco growing on account of the necessity of fallowing the land for seven years before replanting, and this has resulted in the alienation of practically all the land on the East Coast of Sumatra lying between the seaboard and the foothills of the mountain ranges from the Lankat districts on the West to Asahan on the East.

TAXATION.

No direct taxation is imposed on the rubber industry, and to assist planters the Colonial Government some time ago promised that no export duty should be levied on the raw material in the immediate future. It is the general opinion, however, that this condition will be revised before many years have elapsed and an export duty collected. The general revenue of the Colony is derived from a 12 per cent. duty on all imported merchandise, a 4 per cent. income tax, and from various municipal and local taxes.

ELEVATION ABOVE SEA-LEVEL.

The majority of the rubber estates are situated at elevations of from four feet above sea level to a height of not more than 120 feet at the foothills of the mountain ranges. The former elevation covers the flat lands near the banks of navigable rivers, such as the Bila, and certain sections of the tobacco districts, the latter those of the undulating country stretching up to the mountains. A few plantations have been opened at higher elevations, but the area is insufficient at present to form an important factor in the situation. The trees are in a thriving condition at these higher altitudes, even up to 1,000 feet above sea level.

SOIL.

There are three distinct varieties of soil in the rubber districts of Sumatra :—

(1) A black, friable topsoil mixed with sand and lying on a strong clay subsoil, forming the low-lying lands adjoining the larger rivers. (2) A black, friable topsoil mixed with sand on a subsoil of clay and sand and chiefly found in the tobacco districts. (3) A friable chocolate topsoil on a hard laterite subsoil, these characteristic features extending over the undulating lands reaching to the foothills of the mountain ranges. In numbers 1 and 2 the water is near the surface, extensive drainage is necessary and the root growth of the tree is lateral, the tap-root not penetrating below the water level. On the laterite soils the tap-root penetrates to great depth, frequently as much below ground as the height of the tree is above the surface. I met with no intelligent appreciation amongst planters of this radical difference of root growth, or any attempt to take it into consideration when laying out estates. Trees are planted at the same distance apart on high lands where a deep tap-root develops and on low lands where the tap-root disappears and its place is taken by abnormal lateral growth. The trees develop rapidly on both low and high lands, but on the former they are specially liable to serious damage from the severe storms which constantly occur on the East Coast of Sumatra, and at times these reach hurricane force.

RAINFALL.

The rainfall on the East Coast varies considerably and is controlled to a great extent by the high mountain ranges intersecting the Island. The following records are for 1911 :—

Place.	District.	Fall in inches.
1. Medan	Deli	79
2. Soengai Poetih	Serdang	93
3. Soengai Roean	Lankat	117
4. Soengai Gerpa	Lankat	119
5. Tanah Besih	Padang (Tebing Tinggi)	109
6. Lima Poeloeh	Batoe Bahra	94
7. Telok Dalam	Asahan	108

TEMPERATURE.

The temperature varies very slightly throughout the rubber districts as is shown by the following observations taken in March, 1912 :—

Place.	District.	Degrees.		Fahrenheit.
		Max :	Min :	
1. Medan	Deli	94	71	
2. Soengai Poetih	Serdang... ..	92	70	
3. Soengai Gerpa	Lankat	93	68	
4. Tanah Besih	Padang	90	69	
5. Telok Dalam	Asahan	92	68	
6. Tandjong Balei	Asahan	95	70	
7. Bila	Laboean Bilik	93	71	

ORIGIN OF THE SUMATRA RUBBER INDUSTRY.

The original motive for the Sumatra rubber industry was the severe depression in the price for coffee which occurred some 10 years ago, due to the large increase in the Brazilian output. A small area of rubber had been planted previous to that period, and it was known that *Hevea Braziliensis* thrived on the East Coast. The planters looking for a new product to take the place of coffee were encouraged to grow Pará rubber by the successful results obtained in the Malay Peninsula, and gradually the area under coffee was interplanted with trees grown from seed imported from Vallambrosa and other well-known estates in Malaya. The cultivation was fostered by the Colonial Government, and promises were given of freedom from internal taxation and export duty. Following the lead of the coffee planters, a number of tobacco growers also turned their attention to rubber and devoted a portion of their lands to that purpose. In 1909, when the rubber boom began, large sums were subscribed for opening up estates in Sumatra, and forest lands, as well as old estates, were cleared and planted, until from an area of 38,000 acres in 1908, the cultivation in 1912 has reached 220,000 acres.

CATCH CROPS.

On the majority of the older estates in Sumatra the rubber has been grown amongst other crops, and many of the young plantations are now planted with Robusta coffee as a catch crop. There is not the smallest doubt that the Pará trees planted amongst Liberian coffee have suffered severely as regards their development, and in some isolated cases this damage is permanent. For the first two years the shade of the Liberian coffee shuts out light and air from the young trees and the result is everywhere seen in the uneven growth—plantations of 5 and 6 years old often not tapping more than 50 per cent. of the trees. Another catch crop equally harmful is rice which is frequently grown. It only stands to reason that a crop yielding 1,200 pounds of grain and a large amount of straw must be harmful to a plantation of young trees. Tobacco has been tried as a catch crop, but is universally condemned. Robusta coffee apparently is the only product which can be grown in conjunction with Pará rubber without any serious prejudicial effect, so far as I can judge. It certainly retards the growth to some extent, but the rubber trees are not shut out from air and sun; and this coffee gives amazing returns of 15 and 20 hundredweights to the acre when the bushes are from 2 to 2½ years of age. At the present time this coffee is selling at 70 shillings per hundredweight, and at this price the temptation is certainly very great to harvest two or three crops before cutting it out from between the lines of the rubber trees. This is especially so when old coffee machinery exists on an estate and can be used for preparing the Robusta coffee for the market.

HEALTH OF TREES.

In spite of the fact that many trees on the older estates are stunted in development owing to interplanting with Liberian coffee or other catch crops, the general health of the plantations is distinctly good. There is very little *Fomes*, and small damage has been done by white ants; this is due in great measure to the fact that the land is exceptionally clear of decaying timber and roots on account of its former cultivation for coffee and tobacco. But in new clearings also the general rule is an absence of pests. Many estates visited, however, show the effect of strong prevailing winds, and a considerable proportion of trees of two and three years of age were so bent over at three feet from the ground as to interfere seriously with future tapping operations. Many Managers I spoke to on this subject were without any experience in planting rubber, and quite failed to grasp the importance of straight stemmed trees. In spite of the defects mentioned, the general development on young plantations is fair, and the growth, especially in sheltered situations, quite equal to that of Malaya. The trees suffer from nodules in the bark in a similar manner to those in the Malay Peninsula and Ceylon.

GENERAL CONDITIONS IN REGARD TO THE VALUE OF SUMATRA RUBBER.

In connection with the value of rubber plantations in Sumatra it is necessary to divide them into five groups :—

(1) Those consisting of the old Liberian Coffee Estates interplanted with Pará rubber and from which the coffee trees are now rapidly disappearing :

(2) The small area planted some 10 to 12 years ago on low-lying forest lands without catch crops :

(3) The various tobacco plantations converted into rubber estates :

(4) Plantations recently opened on undulating forest lands and cultivated without catch crops :

(5) Recently opened estates planted with catch crops of Robusta coffee in order to defray the cost of bringing the rubber trees to the tapping stage.

In group No. 1 there is practically no capital cost although it is customary to allow a rate of £25 per acre, for the coffee has paid the expenses of cultivation until the rubber trees have become self-supporting ; but this system has resulted in an uneven growth adding greatly to the cost of collecting the latex in the earlier stages of tapping. No. 2 has given satisfactory results as regards growth, but the area is so small that it practically does not affect production as a whole. No. 3 has proved very successful and very economical to bring into bearing, but these advantages were more than counterbalanced by the high prices paid for the lands during the boom. No. 4 is too young as yet to give any return, but promises well as to growth and is generally healthy in appearance.

No. 5 also promises well, but it is too soon to say what the result of interplanting with Robusta coffee will be in regard to the development of the young rubber trees, and as to whether the immediate financial gain from two or three heavy coffee crops will compensate for the damage such cropping may do subsequently to the rubber trees.

Approximately the area of these different groups is :—

Number 1	...	47,000 acres.
„ 2	...	3,000 „
„ 3	...	100,000 „
„ 4	...	20,000 „
„ 5	...	50,000 „

Total ...		220,000 „
		=====

EFFECTS OF THE BOOM OF 1909—10 ON THE SUMATRA RUBBER INDUSTRY.

The immediate effect of the rubber boom of 1909—10 was to increase the area under cultivation by more than 100 per cent. In 1909 the rubber estates covered 100,000 acres, and in 1912, the area planted and ready to be planted is

220,000. The total capital invested in the enterprise in public companies at the end of December, 1911, was:

1. British	...	...	...	...	...	...	£5,068,000
2. Dutch	...	...	...	...	...	...	3,552,000
3. Belgian	...	...	...	...	...	...	350,000
4. United States	...	...	...	...	...	...	800,000
5. German	...	...	...	...	...	...	72,000
6. Hongkong	...	...	...	...	...	...	40,000
7. Shanghai	...	...	...	...	...	...	25,000
8. Private enterprise	...	...	...	...	...	...	513,000
Total							...	<u>£10,420,000</u>

This capital value must be divided into the capital amount represented by estates established on conservative lines and those created as a consequence of the boom. In the former case the cost of bringing a plantation to the bearing stage may be taken at £25 per acre, as will be shown in detail later on in this Memorandum; in the circumstances, the total capitalisation of the industry is out of all relation to the actual necessary expense of opening up the estates. The area of plantations existing on a conservative basis is, approximately, 100,000 acres, and that affected by the "boom" about 120,000 acres. Therefore the position may be summed up briefly as:—

Area.	Capitalisation.	Cost. per acre.
100,000 acres	£2,500,000	£25
120,000 "	£7,920,000	£66

It is evident that shareholders in concerns capitalised on the "boom" price of an average cost of £66 per acre must suffer severely when increased supplies throughout the world bring the value of rubber down to the actual cost of production, *plus* a fair profit, say 15%, to the producer. In any consideration of this question it must be borne in mind that the reserve of land available for rubber cultivation in Sumatra, and elsewhere in the Orient is practically unlimited, that new plantations begin to yield in the fourth year, and that the present condition of the labour supply in the East generally offers no serious obstacle to the extension of the industry.

COST OF OPENING AND BRINGING INTO BEARING AN ESTATE OF 1,000 ACRES OF FOREST LAND FULLY EQUIPPED WITH PERMANENT BUILDINGS, FACTORY AND MACHINERY, CLEAN WEEDED THROUGHOUT AND PLANTED WITH 108 TREES TO AN ACRE.

The estimated cost of opening a rubber plantation of 1,000 acres on forest land situated at not less than 50 feet above sea level includes all necessary charges up to the end of the fourth year, when the yield should be sufficient to allow the capital accounts to be closed. Allowance is made for the cost of obtaining a grant of 1,000 bouws of land (1,750 acres) in order to have a reserve available for future extensions. Felling and cleaning up after the timber is burnt can be done by contract, but constant delays occur in Sumatra owing to the unpunctuality of the native contractors in regard to work; therefore it is more satisfactory to employ daily labour for these preliminary operations, although the expense is slightly higher. No allowance is made for the removal of the stumps of big trees or the destruction of the large logs, as the majority of practical planters do not consider such expenditure justified by results and they prefer to keep a keen watch for any appearance of *Fomes*, white ants or other pests and treat each case as it occurs. The subjoined estimate of the distribution of costs explains itself. It is slightly less in sterling than similar work in the Malay Peninsula,

but this is due in great part to the lower value of the monetary unit (the guilder) as compared to the Straits dollar.

	Guilders.
1. Expenses of land grant of 1,000 bouws, Survey fees, etc.	7,000
2. Rent 1,000 bouws (1,750 acres), 1 gld. per bouw per annum	4,000
3. Felling, clearing and burning 1,000 acres	23,000
4. Clearing up 1,000 acres	7,000
5. Weeding 1st nine months	18,000
2nd year	12,000
3rd "	9,000
4th "	5,000
	44,000
6. Draining..	4,000
7. Roads and Bridges	8,000
8. Lining, Holing and Filling	2,000
9. Planting and Supplying	2,000
10. Nurseries or Plants	2,000
11. Manager's Bungalow	6,500
Assistant's "	4,500
	11,000
12. Factory and Machinery	30,000
13. Lines for Coolies—100 rooms, 10' × 12', at 150 guilders per room	15,000
14. Tools, etc.	10,000
15. Management	50,000
16. Hospital, Medicines, Attendance, etc.	15,000
17. Cost of importing 300 Coolies—first 3 years ...	31,500
" " 400 " 4th year ...	14,000
	45,500
(proportion of Cost of 3 years' Contract).	
18. Contingencies	11,500
	291,000

This sum of 291,000 guilders is equal to £24,250 sterling or £24. 5s. for each acre brought into bearing. Between the 4th and 5th year the estate would be self-supporting.

COST OF MAINTENANCE FOR 12 MONTHS OF AN ESTATE OF 1,000 ACRES OF 6 YEAR OLD TREES PLANTED 108 TO THE ACRE.

The cost of maintaining in first-class order an estate of 1,000 acres with a forest reserve of 750 acres in Sumatra should not exceed the following estimate :—

	Guilders.
1. Rent	1,000
2. Tapping and collecting (including depreciation on cups and implements)	65,000
3. Curing and preparation (including 20% depreciation on Factory and Machinery)	12,500
4. Transport Shipping charges and commission	5,000
5. Management (allows for Manager, 2 Assistants and 2 clerks)	17,500
6. Hospital and Medical Attendance	5,000
7. Weeding	7,500
8. Maintenance of Roads and Drains	5,000
9. Cultivation	5,000
10. Contingencies	6,500
11. Depreciation of Buildings other than Factory... ..	7,500
	137,500

This sum of 137,500 guilders is equal to £11,458 sterling. With an average crop of 250 pounds of rubber to each acre containing 108 trees, the cost per lb. f.o.b. Sumatra works out at 11 pence sterling. It is understood in the above estimate that the amount allocated to hospital and medical attendance is for a share in a central hospital with two or three other estates. If a separate hospital is maintained this charge would be doubled.

The yield per acre should show a substantial increase as the trees grow older and the cost of collection, curing, weeding, management and maintenance of roads and drains will be proportionately reduced per pound of rubber.

In addition to the expenditure already set out the charges from port of shipment in Sumatra to date of sale in Europe are $3\frac{3}{4}$ d. per lb. with rubber selling at $4\frac{1}{2}$ per pound. Therefore the total cost up to date of sale would be $1\frac{1}{2}\frac{3}{4}$ sterling, leaving a net profit of $2\frac{1}{11}\frac{1}{4}$, per pound of rubber. A well-cared for plantation with 108 trees to the acre will certainly yield 250 pounds per acre between 6 years and 7 years of age. Under these conditions a crop of 250,000 pounds from 1,000 acres will leave a total clear profit of £37,000 sterling with rubber at $4\frac{1}{2}$ per pound. A fall in the price to 2/- per pound would automatically reduce the European charges for commissions and rebates by $1\frac{1}{2}$ d. per pound, making the total cost of production $1\frac{1}{4}$ and leaving a net profit of $10\frac{3}{4}$ d. per pound to the producer.

This slightly lower cost of production in Sumatra as compared to Malay is accounted for by (1) the smaller value of the monetary unit and (2) the absence of any export duty or direct taxation on the industry.

DISTANCES APART AT WHICH PARÁ RUBBER TREES ARE PLANTED IN SUMATRA.

The distance apart for planting rubber trees in Sumatra is now generally accepted at 20 feet by 20 feet, and the majority of the estates opened up during the last three years have followed that rule. In view of the rapid growth of the trees this distance is certainly not excessive, but it gives ample room for expansion up to the time the tree is 8 or 9 years of age. This distance gives 108 trees to the acre.

MANAGEMENT OF ESTATES.

The expansion of the Rubber Industry in Sumatra is of such recent date that there are not very many experienced planters in the country. Naturally the ranks have been recruited from the coffee and tobacco planters, and these men accustomed to plantation work are rapidly learning rubber cultivation. The majority of the managers and assistants are of Dutch or Swiss nationality. A few Englishmen are scattered through the country, but the number is extremely limited. The demand for both managers and assistants in the Malay Peninsula has been so great during the last few years that few men from there have cared to take up plantation work in Sumatra under the Dutch flag, and so it happens that although many estates in Sumatra are owned by British companies, and more than half the capital invested is of British origin, the work is superintended by Dutch or Swiss representatives, with few exceptions. Probably the fact that salaries are 40 per cent. lower in Sumatra partly accounts for this state of affairs. The system of plantation management and accounts in vogue in Ceylon and Malaya is gradually being introduced on all rubber estates, and will become generally established in the course of the next few years.

EQUIPMENT OF FACTORIES AND THE PREPARATION OF RUBBER.

The erection of Factories is being rapidly pushed ahead on many of the estates where the tapping of trees has commenced. They are constructed on the model of those working in Malay and Ceylon and therefore there is no need to repeat the description already given in connection with those two

countries. The same machinery and the same methods are employed in the curing and preparation of the rubber. One point, however, merits notice. My attention has been attracted to a new process for preparing the latex, and, if successful, it will undoubtedly be adopted extensively. It is the invention of a Swiss, Mr. Freudweiler, the Manager of the Sennah Estates. The principle is to dry the latex by means of hot air, and without washing or creping or using any acids for coagulation purposes. Briefly described, the method is to pass the latex from a receiving tank through fine sieves into a secondary tank, the latter overflowing into three smaller receiving basins. From the last of these the latex falls gradually upon a wheel of some 15 feet in diameter, fitted with a 15 inch receiving flange. This wheel revolves at slow speed inside a casing, into which hot dry air is forced from below and drawn away at the top by an exhaust fan. The flange of the wheel is fitted with rills at every 3 feet and a knife edged arm works over the surface to keep the latex spread at a uniform thickness. The invention has been tested in Europe and declared to be efficient so far as the working model is concerned. A full sized machine is now in course of construction and will reach Sumatra in about four months time. It is to be installed on the Sennah Companies' Estates and a thoroughly practical trial made of its capabilities. I have not been able to obtain a copy of the specification, but attach a very rough drawing made from the description given to me.

LABOURERS EMPLOYED ON THE ESTATES.

The majority of the labourers on the Sumatra rubber plantations are natives of Java. They are recruited through agents at a cost, at present, of 120 guilders per coolie, 15 guilders of this sum being recoverable from the wages earned. Both men and women are indentured for a term of three years, and at the end of their contract are entitled to a free passage to their homes. Government Inspectors visit the estates from time to time to see that the regulations in regard to housing and general treatment are carried out by the employers.

The hours of work are nine hours per day, beginning about 6.30 a.m., and with an interval of two hours at noon. Work is compulsory on six days in the week and optional on the seventh. On a large number of the estates the bulk of the work is by task, which can be finished by industrious coolies by 2 p.m., and then they are free for the remainder of the day. This system of tasks extends to all branches of ordinary labour on an estate, including tapping and collecting, weeding, roadmaking, cutting drains, and hoeing. On the majority of the plantations visited the Managers expressed themselves satisfied with the work done by the Javanese, but complained that when punishment became necessary they had no adequate means of inflicting it. They are not permitted to fine a labourer, and to bring him before the authorities entails expense and loss of time out of all proportion to any benefit gained.

The rate of wages paid to indentured Javanese is 33 cents a day for men and 28 cents for women under the contract, but on some plantations a higher wage is given voluntarily to expert tappers.

When the three years' contract expires a large number of the coolies prefer to remain on the estates instead of returning to Java. To such men as elect to follow this course a wage of 40 cents per diem is given, but the women continue to receive only 28 cents per day.

Rice is supplied by the employers at cost price, but no other food. On most estates a store is established and rented out to Chinamen subject to certain restrictions in regard to prices on goods sold to the coolies. This is a necessary provision when the estate is at any great distance from any village where supplies can be purchased.

Chinese coolies are employed also on many estates. They are recruited in China through agents and indentured to serve for one year, or, excepting holidays, for 300 days. The cost of introduction at present is 85 guilders per head, no part of which is recoverable. The wage rate for these indentured Chinese is 33 cents per diem. They do fairly satisfactory work, but owing to the heavy cost of introduction and the short term of contract service they prove much more expensive than the Javanese.

Free Chinese labourers are employed largely on the plantations. For these the usual wage is from 50 to 60 cents per diem, but in some cases as much as a guilder a day is paid to them when their services are urgently needed.

The Malay population in Sumatra rarely work as day labourers on the estates, although occasionally they take contracts for felling and clearing forest lands.

At present there is no scarcity of labour on the East Coast of Sumatra so far as the principal rubber and tobacco districts are concerned, but the demand will increase greatly as tapping becomes more general.

The only skilled work required from estate coolies is for tapping and factory work, and any fairly intelligent labourer becomes proficient at both in a very short time under careful supervision. On some estates in Sumatra I have seen quite as good tapping by Javanese as any in Malaya by Indians or Chinese, and the same remark applies to the work in the factories.

HEALTH CONDITIONS.

Throughout the East Coast of Sumatra the health conditions are exceptionally good. There is, comparatively speaking, very little malarial fever or dysentery, and the turn out of coolies for the daily muster seldom shows a greater number than 2 per cent. to 3 per cent. on the sick list. Sanitary regulations are enforced by the Dutch Colonial Government, and properly equipped hospitals are maintained for all estates. The large plantations each have their hospital and a resident doctor; the smaller estates, when possible, combine to establish a central hospital for the use of three or four plantations in order to reduce the cost of accommodation and medical attendance.

ORGANISATION OF A RUBBER ESTATE.

The organisation of a rubber estate in Sumatra presents no exceptional difficulty. A grant of suitable land must be secured from the Sultan of the district selected, and this concession be ratified by the Dutch Assistant Resident. Arrangements are then made with agents to secure the requisite number of Javanese or Chinese coolies, and lines are erected to house them on their arrival. Felling and clearing are commenced immediately, and probably a portion of this work is given out to Malay contractors. As soon as the land is cleaned up after the debris of the timber has been burned, the work of lining and holing at once begins. The planter will follow, probably, the custom established during the last three years and cut his holes 20 feet apart. When holing is finished the work of filling takes place, and planting commences as soon as the weather is favourable.

If nurseries have not been formed plants or stumps can be purchased at prices of from 15 to 18 guilders per 1,000. Many planters prefer planting seeds at stake, and on several estates I visited this method has given excellent results. Weeding should commence immediately the land is cleaned up after the burn; if this work is thoroughly carried out the estate will be free of weeds at the end of the first year and monthly weeding can be established at a low cost. Roads will have been made at the time as the holes were cut, and if any draining is necessary that work will have been taken in hand also.

During the first year arrangements must be made for the construction of bungalows and other necessary buildings. Beyond this work and the weeding there is little to be done after the estate is planted until the end of the third year, except to supply fresh plants where those originally set out have died or been damaged, and to keep a vigilant watch for the appearance of *Fomes*, white ants or other pests. In the third year preparations should be made for the erection of the factory and an appropriate site selected. This work should be completed in the course of the fourth year, when a census of the trees must be taken and those of sufficient girth marked for tapping. This occurs when they measure 16 inches to 18 inches in circumference at three feet from the ground.

If a catch crop of Robusta coffee is grown more work is entailed. The bushes give a first crop when 2 to 2½ years old and the question of setting up the necessary machinery and appliances for curing and preparation for the market must be considered. The attempt should be made to erect the coffee buildings and equipment in such manner that they may be converted into the rubber factory at small expense when the shade from the rubber trees renders the further cultivation of coffee impossible.

However tempting a catch crop of coffee may appear to be, it must not be forgotten that it has certain detrimental effects upon young rubber. Whenever such a crop is cultivated the result is to some extent, even under most favourable circumstances, an irregular growth of the rubber trees, and it almost invariably means that in place of tapping 70 per cent. of the trees in the fourth year only some 40 per cent. to 50 per cent. will be available. This entails extra expense in tapping and collecting, and also a reduced yield during the fourth and fifth years.

The system of tapping in Sumatra is similar to that practised in the Malay Peninsula and has been described fully in connection with the industry of that country.

ESTATE BUILDINGS.

The buildings on the Sumatra rubber estates are similar to those in use in Malaya, with the difference that hard wood frames and thatched roofing are the general rule and only in very few cases does one meet with steel frames and galvanized iron roofing. The principal difference is in the expense of construction, those in Sumatra costing the same number of guilders of 20 pence as the Malayan in dollars of 28 pence.

DISCIPLINE ON ESTATES.

The standard of discipline varies on different plantations. On some estates visited no complaints were made by the Managers, but on others the reverse was the case, and much bitter sentiment was expressed in connection with the attitude of the Colonial Government. The pith of the matter is that the planters are strictly forbidden to punish their labourers, and the authorities will take no effective steps to do so. This condition was confirmed to me by quite independent and reliable persons, such as the Managers of the *Nederlandsche Handel Maatschappij*, and several agents and merchants in Medan and elsewhere. In the Bila district during 1911, one English and two Swiss Managers were murdered by estate labourers. Enquiries failed to show any reasonable provocation for these acts. Apparently the Managers were dissatisfied with the work of certain coolies, and insisted that the men should do their duty in better fashion. Disputes followed in each case, and the coolies attacked the Managers with hoes and knives and killed them. I saw one of the murderers in the jail at Tandjong Balei, where he was serving a term of four years hard labour for his crime. The other men received similar sentences.

DIETARY.

Rice is the principal food of both Javanese and Chinese coolies. The diet also comprises dried and fresh fish, cocoanut oil, curry stuffs, fruit and vegetables. Meat is rarely seen on the plantations, and then only on the occasion of some special festival.

YIELD OF RUBBER TREES.

Accurate records of the yield per acre have not been kept on the Sumatra estates. This is principally due to the fact that the majority of the tapping hitherto has been on trees planted amongst Liberian coffee and other catch crops, and the growth consequently has been so irregular and uneven that the number of pounds of rubber to the acre conveys no definite idea of the real condition of the industry. Some returns of the yield per tree in 1911 were obtained, and I give them for what they are worth, but do not consider they are a true indication for a secure basis of calculation:—

Name of Estate.	District.	Age.	No. of Trees Tapped.	Yield per tree. lbs.
1. Soengei Gerpa	Langkat ..	6½	37,000	3·42
2. "	" ...	5 (from 1/8/11 to 1/3/12).	35,000	·85
3. Blankahan	" ...	6½	49,000	2·45
4. Soengei Roen	" ...	6½	30,000	3·31
5. " Poetih	Serdang ...	6	17,000	1·50
6. "	" ...	5½	5,000	1·90
7. Telok Dalam	Asahan ...	5½	18,083	1·92
8. "	" ...	11	800	7·00
9. Sennah Rubber Company...	Bila	4	30,000	1·33

I do not see that any useful purpose can be served by quoting further instances of yields per tree. As conditions in Sumatra are so very similar to those existing in the Malay Peninsula I think it is safe, and more satisfactory in every way, to apply the Malay averages to Sumatra.

COST OF PRODUCTION IN 1911.

Owing to the method of keeping Estate accounts in Sumatra it is no easy matter to arrive at exact figures in regard to the cost of production of a pound of rubber f.o.b. port of shipment. At present the expenses connected with coffee cultivation are bulked with rubber where the latter is interplanted with the coffee, or where an estate has young trees and older trees in bearing the expense of weeding the estate has not been allocated in proper proportion to capital and revenue accounts. This confusion will be eliminated in two or three years when the rubber industry has further developed, but for the moment I find that the only practical course is to pick out the different items and not rely implicitly on the estate returns. I say this because sometimes when costs f.o.b. have been given to me I have found on investigation that they were quite misleading. In the case of Telok Dalam Estate I was informed that the cost of production f.o.b. for 1911, was 58 cents per pound of rubber. On examining the accounts, I found an item of 3,000 guilders for a supply of cups, sufficient to last for three years, charged against tapping and collecting for 1911. Similarly all the recruiting charges for three years for indentured coolies brought to the estate in 1911 were charged against the cost of production in that year instead of being proportioned over three years. Then, again, depreciation on buildings had been omitted. Taking account of these errors the results worked out at 12 cents per pound less than 58 cents, and the cost f.o.b. was 46 cents or 6·20 pence sterling. The explanation given to me by the General Manager was that he only wished to pay

8 per cent dividend for 1911, and so debited many unusual costs against revenue for that year. After very careful enquiry I consider the average cost of production f.o.b. Sumatra for 1912 and 1913 should be as follows :—

	Cents.	
1. Tapping and collecting	29	Includes depreciation on cups and implements.
2. Curing	5	Includes depreciation on factory and machinery.
3. Transport - - -	1	
4. Commissions and shipping charges -	1	
5. Weeding	3	
6. Cultivation-	2	
7. Management	7	
8. Depreciation	3	On buildings other than factory.
9. Hospital	2	Share of central hospital with other estates.
10. Maintenance roads and drains - -	2	
11. Rent -	1	
12. Contingencies -	2	
	<hr/>	
Total	<u>58</u>	

This is equal to 11½ pence sterling. As the trees become older and the growth in the former coffee plantations less uneven the cost should show a substantial decrease, and the ultimate minimum cost should not exceed 50 cents, or 10 pence sterling per pound of rubber f.o.b. Sumatra.

ANALYSIS OF EXPENDITURE.

An analysis of the foregoing cost of production shows that 70 per cent. is for labour charges. Therefore any increase or decrease in this cost principally depends on the wage rate of coolies and efficient supervision to ensure economy of labour whenever possible. Management and labour combined sum up 47 cents out of a total cost of 58 for each pound of rubber produced. The lower cost as compared to Malaya is due to the smaller intrinsic value of the monetary unit.

CHARGES FROM PORT OF SHIPMENT TO DATE OF SALE.

The charges from port of shipment in Sumatra to London, Liverpool Antwerp, or Amsterdam are the same as those ruling from the Malay Peninsula. Freight from Medan and other ports on the East coast is fixed at 75 shillings per 50 cubic feet. Quite recently an additional charge of 2/6 has been added on account of the coal strike in the United Kingdom. For the purpose of this report commissions are calculated on a selling value of 4/2 per pound, and consequently would rise or fall with any fluctuation in prices. The custom in Sumatra is to pack the rubber in boxes containing 112 pounds, running 10 boxes approximately, to the 50 cubic feet. The charges are :—

1. Freight	·83 pence per lb.
2. Rebate to buyer 2½ % and ½ draft	1·50 " "
3. Brokerage	·25 " "
4. Bale charges, insurance, storage and sundries	·75 " "
5. Merchants' commission	·50 " "
	<hr/>
Total	<u>3·83</u> " "

ESTIMATE OF TOTAL AVERAGE COST PER POUND OF RUBBER
TO BE SOLD IN LONDON OR LIVERPOOL IN 1912.

With the average cost f.o.b. Sumatra of $11\frac{1}{2}$ pence per lb. of rubber, the total cost up to date of sale in London or Liverpool will be $11\frac{1}{2}$ pence plus 3·83 pence, making 15·33 pence per pound during 1912. If a fall in the value of rubber to 2/- should occur, the total cost up to date of sale would be 14·21 pence per pound. As there is every reason to suppose that the ultimate minimum cost of production f.o.b. Sumatra will not exceed 50 cents, or 10 pence, the total cost with rubber at 4/2 would be 13·83 per pound, or with the market value at 2/-, 12·71 pence per pound.

PAST AND FUTURE PRODUCTION.

In Sumatra at present it is useless to apply normal yields to the acreage under cultivation in order to ascertain probable immediate production, for the reason that until 1909 nearly all the rubber trees were interplanted with Liberian coffee, their development choked and their needs neglected in every way. It is only in the last two years that attention has really been given to the rubber trees and the coffee cleared away to allow them a chance to recover from past ill treatment. Trees that should now be yielding 3 lbs. of rubber at 6 and 7 years of age are giving little more than one-third of that amount. That these trees have survived at all is a matter for surprise, and that they are rapidly regaining normal conditions tends to show their amazing vitality. After most careful investigation of past details and existing circumstances I have arrived at the following result in regard to the future production over the area planted, or to be planted, before the end of 1912:—

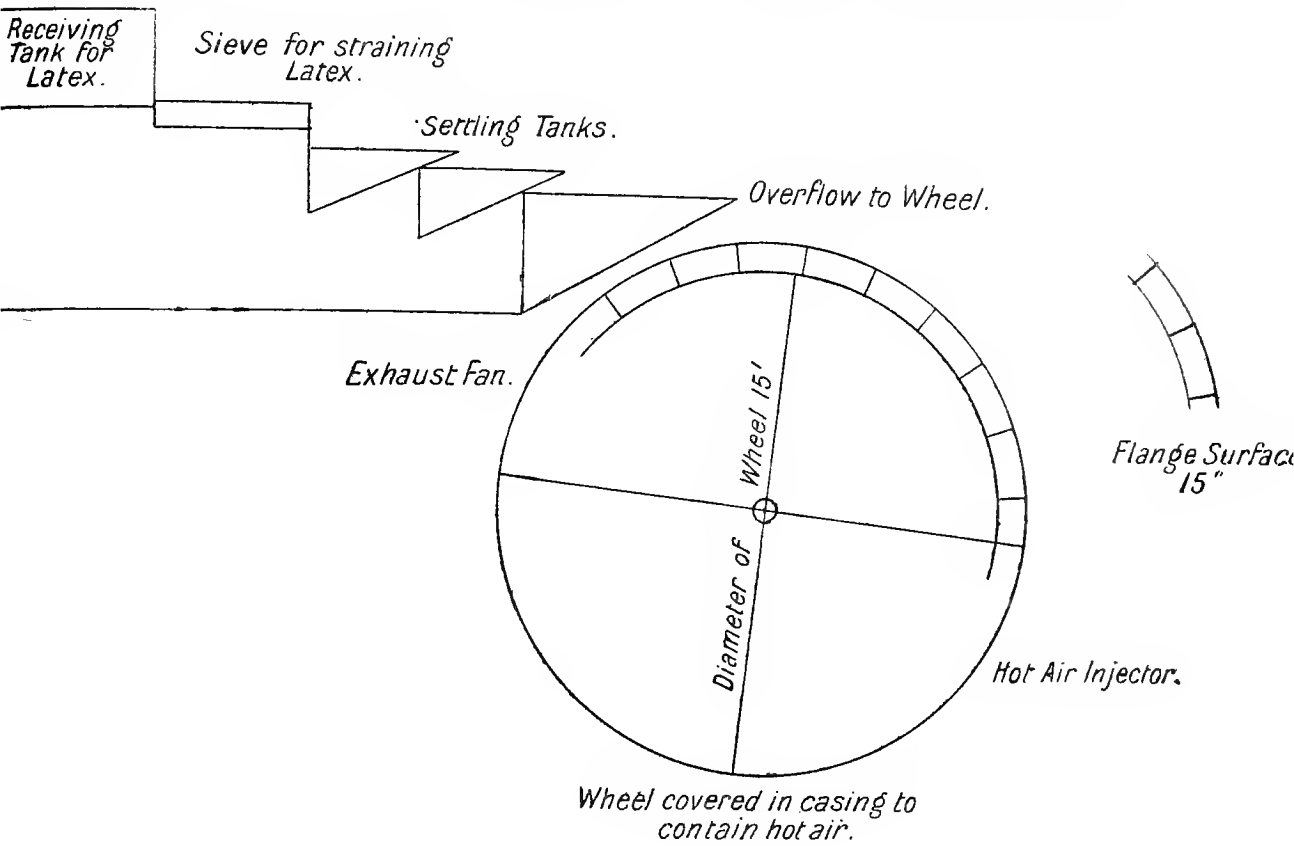
Year.	Area under cultivation.				Yield.
	(Actual).				
1906	6,140 acres	...	80 tons.
1907	20,150 "	...	100 "
1908	38,800 "	...	150 "
1909	67,000 "	...	214 "
1910	100,000 "	...	330 "
1911	160,000 "	...	678 "
			(Estimated).		
1912	220,000 "	...	1,700 "
1913	220,000 "	...	3,500 "
1914	220,000 "	...	8,000 "
1915	220,000 "	...	12,000 "
1916	220,000 "	...	16,000 "
1917	220,000 "	...	22,000 "
1918	220,000 "	...	33,000 "
1919	220,000 "	...	44,000 "

No allowance has been made for any yield from trees planted after 1912, but the production will be considerably increased from this source, for trees planted in 1913,-14,-15,-16, will be in tapping at the end of 1919. This extra production will more than compensate for any unforeseen damage to the existing area.

SINGAPORE

23rd March, 1912.

THE FREUDWEILER SYSTEM OF CURING FIRST LATEX.



This process appears to me to be feasible, for hot dry air will certainly coagulate rubber latex dropped on a surface in thin sheets. If the invention is a practical success every estate in the Orient will use it in order to save labour and time in drying and preparation. I do not think, however, that it can be utilised for lump, scrap, bark or earth scrap, and therefore every factory will require the creping and washing machines now in use as well as this new patent. If the drying is as perfect as represented and does not produce "tacky" rubber, the first latex when stripped from the wheel will be pressed in hydraulic presses, baled and shipped to Europe. I estimate that the saving effected would be not less than 1d. per lb. if the process is successful in practice.

REPORT

OF THE

RUBBER INDUSTRY IN THE ISLAND OF JAVA.

CURRENCY UNIT : 1 GUILDER = 20 PENCE.

REPORT ON THE RUBBER INDUSTRY IN THE ISLAND OF JAVA.

The Commissioners visited the Island of Java, arriving at Batavia in the latter part of March. They made a tour through the principal districts where rubber is cultivated and inspected a number of estates. They returned to Singapore towards the end of April.

LOCALITY.

The rubber estates of Java are scattered over the Island from East to West, but much more numerous on the Southern Coast than on the North, due to the fact that the rainfall is greater and more regular in the South. The principal districts where plantations have been opened are near Buitenzorg and Krawang in the Province of Batavia; Rangkasbidoeng and Menes in Bantam; Tjandjoer to Bandoeng and Banjar in Preanger; Langen, Tjipari and Kiliminger in Banjoemas; Malang and Limburg in Pasoeran; Djember, Kalisat and Banjoewani in Besoeki; and at various points in the provinces of Kediri and Soerabaja. In nearly all districts where coffee plantations formerly existed rubber has been planted whenever conditions of climate and soil permitted. Experiments tried with Pará rubber in the Northern sections of the island between Batavia and Soerabaja have not proved successful owing to climatic reasons, and no plantations of importance are found in those districts.

ELEVATION.

Java differs from any of the rubber producing countries yet visited in that Pará rubber flourishes at elevations varying from sea level to 2,000 feet. At the latter height the growth may be somewhat slower, although it is difficult to express a definite opinion on this point as all the rubber at high elevations has been interplanted with other cultivations and little attention given to it in its earlier stages. As regards yield of latex there is very small difference from trees of the same age at low and high elevations, and this is in marked contrast to the general characteristics prevalent in Ceylon—the only country where the physical conditions in any way resemble those existing in Java. The only plausible explanation is that South of the Equator different climatic influences come into action and rainfall and temperature are not affected by atmospheric variations to the same extent as happens in countries lying further to the North.

CLIMATE.

The following statistics collected from various rubber estates give a general idea of the climatic conditions:—

Estate.	District.	Elevation. Feet.	Max. — Min. Fahrenheit.	Rainfall. Inches.
1. Kiara Pagoeng	Tjandjoer	1,800	84 — 67	164
2. Tjirandi	Tjandjoer	950	86 — 69	125
3. Baud (tea)... ..	Bandoeng	2,400	83 — 64	141
4. Pasir Oetjing	Bandoeng	900	86 — 69	136
5. Batoe Lawan	Banjar	200	91 — 72	137
6. Banjasari	Banjar	50	92 — 71	121
7. Tjipari	Banjoemas	500	87 — 70	131
8. Kiliminger	Banjoemas	200	85 — 71	135
9. Limburg	Malang	1,050	84 — 68	125
10. Kalidjeroek	Djember	800	83 — 69	137
11. Mamboel	Djember	300	84 — 69	135
12. Glen More	Bangoewany	200	85 — 70	96
13. Buitenzorg	Batavia	700	87 — 70	124
14. Rangkasbitoeng (Tjikadoa)	Bantam	200	87 — 71	117
15. Menes (Pasir-Wringin) ...	Bantam	260	87 — 71	198

(heavier rainfall caused by proximity to mountain ranges.)

The foregoing observations show a very even temperature and a plentiful average rainfall on the East, West and South sections of the island and doubtless explain to some extent the high average yields of latex at comparatively high elevations. The heavy rainfall at Menes is due to its proximity to a high mountain.

SOIL.

Throughout the highlands of the greater part of Java the soil is red laterite with a considerable depth of top soil on all the forest lands. On low lying flat lands the general characteristics are a dark brown greasy top soil on stiff blue or yellow clay, and these lands require extensive draining to free them from the accumulations of excessive moisture. In the Eastern provinces of Pasoerean and Besocki the soil in the highlands is a rich chocolate friable loam, not infrequently mixed with black scauria thrown up by the great volcanoes in the districts. The soil of the low lying flat lands is a rich brown clayey loam mixed with sand, and this alternates at times with a black and sandy soil of volcanic origin. On the laterite soil the growth of the rubber trees is more satisfactory and there is less disease than in the low lying clay districts, but the latter could be very much improved by adequate draining and occasional forking over combined with the application of lime as a top dressing. Near Rangkas-Bitoeng a curious and almost white soil, very loose on the surface and hard a foot or two below crops up. The *Hevea* planted on it looks fairly well and yields freely.

AREA.

Official returns made in 1910 gave the area planted with Pará rubber as 158,000 acres on 215 estates; in addition there were under cultivation 1,086,126 *Ficus* trees, 687,748 *Casbilloua* trees and 356,253 *Ceara* trees. In 1911 some 50,000 acres were planted with Pará rubber, and in 1912 the additional area planted or ready for planting is not less than from 22,000 to 25,000 acres. This estimated area for 1911 and 1912 is compiled from information supplied by estate agents and planters; it is probably less than the actual amount and must be considered a very conservative figure. Summed up the approximate area is:—

					Aggregate acres.	Increase acres.
1910	...	...	...	...	158,000	—
1911	...	...	...	...	208,000	50,000
1912	...	...	...	...	230,000	22,000

The extensions in 1911 and 1912 are directly due to the rubber boom of 1909-10, and took place principally in the Eastern districts in the provinces of Besocki, Pasoerean and Kediri.

DATE OF FORMATION OF ESTATES IN JAVA.

In 1898, when the price of coffee dropped so low as to leave no profit to the planters, efforts were made to find some product to take its place. The question of converting the coffee estates into rubber plantations was considered in many districts and application was made to the Government Agricultural Department for advice as to cultivation and the species of rubber-bearing tree most suitable for the conditions prevalent in Java. The authorities at Buitenzorg recommended the planting of *Ficus*, *Casbilloua* and *Ceará*, and expressed the opinion that Pará rubber (*Hevea Brasiliensis*) was ill adapted to the soil and climate of the island. The cultivation of *Ficus Elastica* was strongly advocated on the grounds that it was a natural product of the Java forests. It is due to this advice on the part of the Agricultural Department that so large an area of *Ficus Casbilloua* and *Ceará* trees are found to-day in Java. The cultivation of Pará rubber was only began seriously about 1905, when the experiences of Ceylon and the Malay Peninsula showed clearly its

great superiority over other rubber yielding trees. In a few districts a limited number of *Hevea* trees had been planted and the growth of these proved that they could be successfully cultivated, contrary to the opinion expressed by the authorities at Buitenzorg in 1898. In 1906-7-8 arrangements were made to obtain seed from the Klang district of Selangor, and a considerable number of coffee estates were then interplanted with Pará trees. In 1909-10-11, this cultivation was greatly extended in conjunction with the planting of Robusta coffee as a catch crop.

On one estate visited, Pasir Oetjing, near Bandoeng, I saw about 200 trees planted from seeds collected in the Amazon valley in 1899, and sent to Paris to the care of Mr. Godefroy-Lebeuf. After germination the plants were sent to Mr. A. Bovis, who planted them at Pasir Oetjing and personally described the circumstances to me. An account of these trees was published in the *Journal d'Agriculture Tropicale* of May 31st, 1904. They belong to the black variety of the *Hevea Brasiliensis*, considered in the Amazon Valley to be superior in resiliency to the white species cultivated throughout the Malay Peninsula, Ceylon and elsewhere in the East.

TENURE OF LAND.

Land is held under long leases, seldom less than 75 years, issued by the Dutch Colonial authorities; in the case of semi-independent Sultanates the grant is made by the Sultan and approved by the Resident Commissioner. The annual rental varies from 1s. 8d. to 5s. 10d. per annum per bouw of $1\frac{3}{4}$ acres. A large proportion of the public waste lands is now reserved for the purpose of native plantations of rice and other food stuffs, and grants for establishing rubber estates or other cultivations are difficult to obtain. It is, however, easy to buy from the owners of existing leases, the price varying from a few shillings to several pounds sterling per acre according to the conditions and situation of the property.

TAXATION.

In addition to the annual rental paid for leasehold land a tax of $\frac{3}{4}$ of 1 per cent. is levied on a valuation made once in every five years. While this cannot be considered a very heavy contribution it must be taken into account in all propositions for opening up rubber estates. No export duty is exacted on rubber shipments. The general revenue of the Colony is derived from 12 per cent. duties levied on all imported merchandise, a personal income tax of 6 per cent. and various municipal rates levied on house property and other real estate in the cities and towns.

CAPITALISATION OF JAVA RUBBER ESTATES.

At the end of 1910 the amount invested in joint stock Rubber Companies in Java was :—

Nationality.	Authorised Capital. Guilders.	Shares Issued. Guilders.
1. Dutch	17,757,000	11,240,700
2. Belgian and French	20,700,000	18,042,000
3. German	1,300,000	1,150,000
4. British	89,000,000	74,500,000
	<hr/>	<hr/>
	128,757,000	100,932,700
	<hr/>	<hr/>
	= £10,729,750	= £8,411,058
	<hr/>	<hr/>

Since those statistics were compiled many additional Companies have been formed and the greater part of the unissued shares have been sold, so that to-day the total issued capital of the rubber joint stock undertakings in Java is not far short of £12,000,000. The value of any debenture issues or other fixed interest charges in connection with these Companies is so small that it need not be taken into consideration. Under the heading of British Companies is included the value of various undertakings originating in Hong Kong and Shanghai.

For general financial purposes the rubber estates in Java must be classified under three headings:—(1) Those opened up on economical lines before the rubber boom of 1909–10 and not sold during that period of inflated prices; (2) Old estates purchased during the boom, or new plantations opened at that time; (3) Estates now being formed with expenditure restricted to a reasonable limit. Under the three categories the approximate values are:—

	Acres.	Value.	Average per Acre
1. Old estates with original capital ...	80,000 ...	£1,600,000 ...	£20
2. Estates capitalised in 1909–10–11	128,000 ...	£9,750,000 ...	£76
3. Estates now in formation ...	... 22,000 ...	£550,000 ...	£25

With regard to the estates under the first heading the actual expenditure on rubber has been very small, as on all such properties it was interplanted with coffee. In any considerations of the estates capitalised during the boom period allowance must be made for the large area of waste land acquired by the companies in addition to and out of all proportion to the extent of the portions planted with rubber. A sum of £5 per acre for this may be deducted, thus reducing the cost per acre under the second class to £71. Under the third heading the price given is the average cost per acre of opening an estate and bringing it into bearing, but does not include any premium paid for the acquisition of a lease of the necessary land. It is difficult to estimate the value of this premium, for if a government grant is obtained the only payments are the survey fees; if the transfer of a lease from a private individual is arranged the value of the premium may be anything from 10 shillings, or even less, to 2 or 3 pounds sterling, but as a general rule for rubber lands I do not consider the average price should exceed £1 per acre.

COST OF OPENING AN ESTATE OF 1,000 ACRES AND ITS MAINTAINENCE UNTIL THE END OF THE 4TH YEAR.

The cost of opening and maintaining 1,000 acres under rubber in Java until it is self-supporting should not exceed 297,600 guilders, equal to a little less than £25 per acre exclusive of any premium paid for the acquisition of the land. This cost is distributed as follows:—

	Guilders.
1. Clearing, felling and burning	15,000
2. Cleaning up after burning	20,000
3. Lining, holing and filling... ..	2,000
4. Roads and Drains... ..	12,000
5. Weeding—1st 9 months	27,000
, 2nd 12 ,,	24,000
,, 3rd 12 ,,	18,000
,, 4th 12 ,,	12,000
	<hr/> 81,000
Forward	130,000

	Brought forward	Guilders.
6. Management				130,000
Manager, 600 per month				
2 Assistants, 200 each per month				
2 Clerks, 100 each per month				
Contingencies, 2,000 per annum	65,600
7. Planting and supplying	2,000
8. Nurseries or purchase of plants	4,000
9. Bungalows				
1 at 3,000				
1 at 2,500				
1 at 500 (clerk's)	6,000
10. Factory and Machinery	30,000
11. Lines for Coolies (125 rooms)	20,000
12. Hospital and Maintenance 4 years	10,000
14. Rent	4,000
15. Contingencies	26,000
				297,600
				297,600

This expenditure is calculated on the actual cost of labour on rubber estates, whether the work is done by contract or by daily payment of wages. In some respects work in Java is cheap compared with Malay or Sumatra. Serviceable bungalows constructed with wooden frames and interlaced bamboo walls can be built for 2,500 guilders, equal to similar buildings in the Malay Peninsula costing not less than 4,500 dollars, and often exceeding that sum. Then, again, there are no government regulations concerning lines for coolies or for hospitals, although for the most part both these important essentials are well looked after by the estate managers. As a rule the Javanese coolies prefer to live in small huts divided into two or three rooms, and this type is found generally on the plantations in contrast to the barrack-like accommodation provided in the Malay Peninsula and Sumatra.

WORKING EXPENSES OF A RUBBER ESTATE.

As is the case in all rubber growing countries, the larger proportion of the expenditure is for the payment of labour and the cost of management. The rate of wages varies so greatly in different districts, and even on different estates in the same district, that no hard and fast rule can be laid down for estate expenditure, but I have taken the average of a number of plantations in various localities and so obtained an approximate estimate of the necessary expenses. Another factor to be taken into account is that Managers and Assistants are paid small salaries with a bonus on profits. The custom in Java is to allow the Manager 10 per cent. and the Assistants $2\frac{1}{2}$ per cent. on the net profits, while the salary of the former seldom exceeds £500 and the latter £250 per annum on important properties with very extensive interests at stake. When an estate has reached the producing stage this bonus system appeals strongly to the individual Manager, but a good many complaints are heard in connection with newly opened rubber plantations where 4 or 5 years must elapse before the concern becomes dividend paying. I think that much of the enthusiasm in Java for interplanting rubber with coffee and other products arises from the desire to earn profits at an early date. The following is an approximate cost of maintaining a rubber estate of 1,000 acres of 6 to 7 year old trees planted

20 feet by 15 feet (149 to 1 acre) and yielding a crop of 280,000 pounds of dry rubber :—

	Guilders.
1. Rent, 1,000 acres at 1 guilder per acre	1,000
2. Tapping and collecting (including 50% depreciation on cups, buckets, implements, etc.)	117,600
3. Curing and preparation (including 20 per cent. depreciation on factory and machinery)	11,250
4. Transport, shipping charges and Commission	5,600
5. Management, Manager, 2 Assistants, 2 Clerks... ..	11,250
6. Weeding (50 cents per acre)	6,000
7. Maintenance of Roads and Drains	6,000
8. Cultivation	8,500
9. Manuring	8,500
10. Depreciation of Buildings other than Factory	6,000
11. Hospital and Medical attendance (optional but in my opinion necessary)	5,000
12. Contingencies (Taxes, etc.)	5,000
	191,700
	= £15,975 sterling.

An allowance of 8½ guilders per acre has been made for manuring, as with the present system of exhausting the land with catch crops of coffee or other products some return to the soil must be made.

The cost of tapping and collecting is very much higher in Java than elsewhere in the Orient for reasons explained later in this report.

REVENUE FROM AN ESTATE 6 TO 7 YEARS OLD.

The yield of dry rubber from an estate planted 15 feet by 20 feet with 149 trees to the acre should not be less than 250,000 pounds under normal conditions, basing such figures on the actual returns per tree as shown later on in this memorandum and after making due allowance for local conditions. The account at the close of the 6th year should be :—

Pounds of dry rubber.	Value at 4s. per pound.
250,000 	£50,000

The annual expenditure is £15,975. Freight and charges port of shipment to sale are 4d. per pound, or a sum of £4,080. The bonus to Manager and Assistants would be £5,391. Directors' fees and secretarial expenses in London or elsewhere about £1,500. Therefore the final return should be :—

Gross return... ..	£50,000
Less : Freight and charges... ..	£4,080
" Commission	5,391
" Cost production, f.o.b. ..	15,975
" European Directors and office	1,500
	26,946
Nett Profit	£23,054

On a capital expenditure of £25,000 this would enable a dividend of 90% to be paid. If the price of rubber should drop to 2/- per pound the revenue would still cover expenses and leave a substantial credit balance. Allowing that no reduction be made in the annual estate expenditure, other items would

automatically decrease. Various charges would fall to £2,500 or less; Managers' Commissions would be reduced to £2,770. If the European Directors' fees and office charges are unaltered the total expenditure for the year would be £22,745, leaving a net profit of £2,255, sufficient to permit the payment of an 8% dividend.

MANAGEMENT OF RUBBER ESTATES IN JAVA.

The planting industry of Java has been established for so many years that experienced estate managers for tea, coffee, tobacco, sugar, cacao, cocoanuts, coca, and almost all branches of tropical agriculture are found in large numbers in the island. For rubber plantations, however, there is a great scarcity of experienced managers. In knowledge of tapping and general conditions in connection with Pará Rubber there is a marked lack of competent men. Of course this is only a passing phase, for with the expansion of the rubber area and the beginning of the production stage serious attention is being given to the matter, and both managers and assistants are being sent to the Malay Peninsula in considerable numbers to learn the methods employed and the general conduct of the business. In Java a fair number of Englishmen and some Frenchmen and Belgians are employed, but the great majority of managers and assistants are Dutchmen. The question of language is not an easy one for the newcomer, for to be thoroughly efficient he should understand and talk fluently Dutch, Malay, Sundanese, Javanese and in some districts Madoerese. In several districts I have visited Sundanese and Javanese only were spoken by the labouring classes, and Malay was practically unknown. In the planting districts of the extreme East such as Bangoewani and other parts of Besoeki the majority of the plantation hands are recruited from the island of Madoera and only understand their own dialect.

DISTANCES FOR PLANTING IN JAVA.

The planting of estates in Java varies in every district. On some of the older plantations the trees are distant apart only 7 feet \times 7 feet, 8 feet \times 8 feet, and 12 feet \times 10 feet. In most such cases these trees are being thinned out, but the process leaves an uneven growth and is unsatisfactory. Other estates have gone to extremes in the opposite direction and planted 24 feet \times 24 feet and 24 feet \times 30 feet. Again I have seen instances of 12 feet \times 36 feet over a considerable area. Probably as an average 15 feet \times 20 feet, giving 149 trees to the acre, may be taken for purposes of calculation.

THE EQUIPMENT OF FACTORIES AND PREPARATION OF RUBBER FOR THE MARKET.

Many estates are erecting factories devoted solely to the preparation of rubber, but hitherto the area in bearing has been so limited that makeshifts have been resorted to by adapting a portion of the existing coffee stores for the preparation of the latex.

The system followed in the Malay Peninsula has been adopted generally as the basis for the design of the Java factories, but in many cases water power already applied for the purposes of coffee machinery, can also be utilised, and this should prove a saving in cost of production in future years. A disadvantage in Java, however, is the excessive humidity of the climate, necessitating 6 to 8 weeks for the drying of crepe rubber of medium thickness. When the larger estates come into full production it will be impossible to handle the output by the present method of hanging in sheds, and machinery for drying by artificial heat will have to be erected. Probably the Passberg Vacuum Dryer will be brought into general use unless some more effective apparatus can be found. The methods of treating the latex do not differ

materially from those already described in connection with Ceylon and the Malayan industry, and therefore no repetition of the description is necessary in connection with Java. The manipulation of rubber by hand is rapidly being superseded by power driven machinery and smoked sheet is giving way to crepe.

MARKET FOR JAVA RUBBER.

At present the small amount of rubber exported goes principally to London or Rotterdam. To the former place the freight charge is 79 shillings and 5 pence per 50 cubic feet and to the latter 74 shillings and 5 pence. A small quantity is shipped to Singapore and sold at the regular rubber auctions, and there are indications that such shipments may increase in the future. Prices in Java are governed by London and Liverpool quotations, local sales allowing for a deduction equivalent to the value of freight, insurance and commissions.

THE SUPPLY OF LABOURERS FOR THE RUBBER ESTATES.

With a population of some 35,000,000 natives it would seem that no difficulty should be experienced in Java with regard to the requirements of the sugar, tea, tobacco, coffee, rubber and cocoa plantations. Such, however, is not the case, and with rubber estates particularly the number of coolies available is most inadequate in many districts. There is no doubt that the scarcity in the supply of labour for plantation purposes is due in great part to the large area under cultivation. The rice fields extend to over 3,000,000 acres, sugar some 600,000 acres, tobacco 200,000 acres, tea 250,000 acres, and a similar area under coffee and rubber combined, native food stuffs and fruits to not less than 1,000,000 acres, cocoa nuts 200,000 acres, and probably not less than 500,000 acres altogether in other cultivations. This means that a combined demand exists for coolies to cultivate 6,000,000 acres, and in addition, there is an annual drain to Sumatra of some 50,000 labourers and to Malay of 10,000 for work on the rubber estates in those countries. It must also be remembered that the native methods of cultivating rice fields and gardens for fruit and food stuffs is antiquated and extravagant, and labour saving machinery and modern implements practically unknown.

In the Eastern districts a large proportion of the coolies employed are recruited from the island of Madoera close to the province of Soerabaya. This island is poor in agricultural resources, but has a large population of poverty-stricken inhabitants of whom a considerable proportion are willing to work on the plantations on the mainland. They are weak and sickly on first arrival on the estates, but make useful labourers after a period of a few months of regular rations has improved their physique.

There is no system of contract labour in Java. The coolies are free to work for any rate of wage they can obtain, and they take full advantage of this condition, leaving an estate whenever they feel inclined to do so without the smallest consideration for the inconvenience occasioned by such action. In order to check this inclination estate Managers endeavour to form resident colonies of plantation coolies, and to those who remain permanently a higher wage is granted and many privileges allowed. On old established estates this resident labour force is a prominent feature, but on rubber plantations it is only a limited factor owing to the comparatively recent development of the industry and its unpopularity compared to other cultivations. Another reason is that the climate and land best suited for growing Pará rubber is situated generally in unhealthy districts and in somewhat inaccessible localities, where food supplies and other necessaries are expensive and not always easy to obtain.

WAGE RATE OF LABOURERS.

The rate of wages paid to coolies varies in every district and even on adjoining estates in the same district. I visited tea estates where the daily payment was 17 cents for men and 15 cents for women, while children of 12 to 14 years of age earned 8 to 10 cents a day. A small present was given at the end of the month if the output of leaf was particularly good, but the average payments to men were only at the rate of 5 guilders per month and to women and children in like proportion. These coolies were resident on the plantations and appeared perfectly satisfied with their condition. At a rubber estate only a few miles distant the men were receiving 40 cents and the women 30 cents per day, but the labour force was constantly changing. The average wage paid on rubber plantations throughout Java may be taken as 40 cents for men, 30 for women and 15 daily for children for ordinary work; and 45 cents for men and 35 cents daily for women for tapping. I do not find any marked indication of any immediate alteration in these wage conditions, for it happens nearly always that when an estate succeeds in obtaining labour for a lower rate of pay some neighbouring planter who is short of hands offers additional money inducement and the coolies go to him. There is no cohesion among planters to check this state of affairs.

HOURS OF WORK.

The working hours are nominally from 6 a.m. to 4 p.m. with one hour of rest at noon. As a rule, however, all plantation work is divided into tasks which the coolie with a little additional application and energy can finish by 2 p.m. This piece work system is found to be more satisfactory for the estate and the coolies.

DISCIPLINE.

In view of the large number of labourers employed in agricultural undertakings in Java the general standard of discipline is maintained fairly well. There are occasional instances of rioting and insubordination on plantations, and these are sometimes quite unjustified, and as a rule originate in imaginary grievances not appreciated by the manager or his assistants. Every now and then, however, serious incidents take place and result in the murder of a manager or assistant, but they are few and far between.

STANDARD OF LIVING.

Where the system of resident colonies of labourers has been established each family has a house or part of a house allotted to them or land given them on which they can build for themselves and remain in possession as long as they continue working on the estate. In many cases plots of land are allowed to them for the cultivation of fruits and vegetables for their own use. The dietary includes rice, curry stuffs, fruit and vegetables, and occasionally pork or poultry, but meat is rarely eaten.

HEALTH OF COOLIES.

Health conditions vary greatly in Java. In the high lands there is not a great deal of malaria, but dysentery and small pox are not infrequent. In the district of Malang an outbreak of bubonic plague occurred last year and occasioned some 10,000 deaths, but I heard of no European contracting it. In the low lying districts malarial fever is prevalent, and at certain seasons of the year the practice is to administer daily 5 grain doses of quinine to all estate coolies.

ORGANISATION OF A RUBBER ESTATE IN JAVA.

The work of the organisation of a rubber plantation in Java differs in no essential particulars from the description given of similar work in Malay or Sumatra, except in the matter of the labour question already alluded to. The preliminary work of felling, burning and cleaning up can be contracted for, but the price shows small difference whether arranged by contract or executed with daily labour. There are no government restrictions in regard to dwellings for coolies or hospital accommodation, but it is found by experience that these factors in estate life require careful and serious attention in order to make the place popular for labour. On the rubber plantations in Java it has become an established custom to grow catch crops of Robusta, Quillou or Uganda coffee for the first five years after the estate is opened. While catch crops have been condemned in Malay and Sumatra there is a good deal to be said in favour of cropping with these varieties of coffee in Java.

EFFECT OF CATCH CROPS OF COFFEE.

Where catch crops of Robusta, Quillou or Uganda coffee are planted at the same time as rubber in Java, the effect is less detrimental than might be expected. The young rubber trees obtain a fair start before they are shut in by the growth of the coffee bushes and the estate is kept cleaner from weeds than would be the case if no catch crop was planted. At the end of the second year the coffee trees are topped at 6 feet from the ground, and by this time the rubber has attained a height of some 12 or 14 feet, so that it is never excluded from light and air. The danger to some extent lies in the third and especially the fourth year, when in order to obtain bigger coffee crops the Dutch planters are apt to prune the rubber heavily to reduce the shade for the coffee. If the coffee is cut away at the end of the fourth year, as was the case on some estates inspected, no great harm appeared to be done to the rubber beyond a slightly restricted condition of development. If, however, an attempt is made to obtain a crop of coffee in the fifth year the rubber trees most undoubtedly suffer, and unevenness in their development becomes most noticeable. Moreover, the thick growth of the coffee bushes interferes seriously with the supervision of tapping, with the result that the work is badly done and very costly.

One reason given by planters in Java for growing coffee together with rubber is that the former serves to make the estate popular with labourers, for the reason that they can earn better wages at picking coffee than at almost any other cultivation. It is easy work and a woman with one or two of her children to help her frequently obtains a wage of one guilder (1/8) a day.

The financial point of view also must be considered. With a small crop in the second year, another of 10 to 12 hundredweights per acre in the third, and a similar yield in the fourth season and with coffee selling at its present price of about 65 shillings per hundredweight, an actual profit of £30 sterling per acre can be made by the time the rubber trees are ready for tapping. In other words the rubber has cost nothing and a clear £30 per acre has been made over the area cultivated. Moreover catch crops of coffee under existing conditions appeal to the managers of estates, as a percentage of the profits falls to their share.

WEEDING.

Clean weeding, apart from those estates interplanted with coffee, is not the general rule in Java. Planters give as a reason that the trees do not suffer as long as lalang and other pernicious grasses are kept under; indeed, they go so far as to say that weeds are beneficial to prevent wash in heavy rains and useful for keeping the ground moist in seasons of drought. Personally I do not agree with such theories, and consider that other measures, such as draining, should be adopted to remedy the damage caused by superabundant

rainfall, and that the effects of dry weather should be met by forking over the ground at frequent intervals. In fact I think that the somewhat dirty appearance of the majority of estates in Java is due to careless management or lack of funds to employ sufficient labour.

TAPPING.

The standard of tapping at present practised in Java is far from satisfactory. It is true that this class of work is only at its commencement, but with the example of the damage done in the Malay Peninsula by careless work a few years ago it is inexcusable that the Java planters should not make greater efforts to learn for themselves and teach their coolies how to work in a more efficient manner. A reason given for this unsatisfactory condition of affairs is that the labour on rubber estates is seldom permanent, and that as soon as a batch of men are expert at this work they leave for other estates where they can obtain a higher wage; or the rice harvest at their village begins and they forsake the plantation and return to their homes. There is a great deal of truth in both these assertions, and they will be for some years to come an obstacle to good tapping. A more serious point, however, is that in view of the difficulties of retaining good tappers an insufficient amount of daily labour is required from them and the cost of the work consequently is far higher than in Malay, Sumatra or Ceylon. In fact on several estates I visited the daily task was approximately one half of that accomplished in the three countries named under similar conditions of age and growth of trees.

HEALTH OF TREES.

The usual diseases to which the Pará rubber tree is subject are present in Java. Canker is found in all plantations, but especially so in the low-lying lands near the sea coast. In the Banjoemas district it is prevalent to a marked degree, and I saw considerable areas suffering severely on the Langen and Banjarsari estates where the soil was clay and very wet.

Possibly better drainage and the application of lime may remedy the evil, but it will only be eradicated at comparatively high cost. On the laterite soils on the hilly and undulating lands it is much less in evidence, but it exists and requires constant watching and treatment. *Fomes* and "Dieback" are both found, but so far threaten no serious damage if taken in hand as soon as the trees are found to be infected. White ants exist, but do little harm. With the exception of the estates on the very low-lying wet lands where canker has a strong hold, there does not appear to be any reason to suppose that disease will prove a serious factor in the development of the industry.

EXTENSION OF THE JAVA RUBBER INDUSTRY.

There is ample room for the extension of the industry as far as suitable land is concerned. The general inclination in Java, however, is to hold back from attempting any large fresh clearings until some tangible result is obtained from the area now under cultivation. Much depends upon the course of coffee prices during the next few years, for there is no doubt that if any great expansion of the growth of the Robusta, Quillou and Uganda coffees takes place it will be accompanied with a corresponding increase in the area under rubber; for the planting of the latter can be done at practically no cost beyond that of seed for the nurseries and the labour of putting out the plants in the fields. The Dutch planter likes to have two strings to his bow, and many of them have told me that they would always put in coffee and rubber together and decide later on which crop would pay them best to retain under cultivation.

YIELD OF TREES.

The Java industry is still in its preliminary stages of development, and therefore it is impossible to obtain satisfactory returns over definite areas on which to base calculations of averages. I have visited estates where many thousands of trees are in tapping this year for the first time, but too scattered to give the results per acre for any useful purpose. I give the yields per tree in various districts, but they only serve as an indication :—

Altitude feet.	Estate	District.	No. of trees tapping.	Average yield lbs.	Age years.
600 to 1,850	(Kiara) Pagoeng	Preanger ...	31,150	1.60	4-5
800	Tjirandi ...	" ...	49,000	1.35	4-6
800	Pasir Oetjing ...	" ...	80,000	1.80	4-6
			(100 trees 11 years)		
200	Batoe Lawan ...	Banjar ...	19,437	1.70	4-5
50	Banjarie ...	" ...	31,000	1.75	4-6
100	Langen ...	Banjoemas ...	148,000	1.53	4-5
50 to 600	Tjipari ...	" ...	32,000	1.25	4-5
1,050	Limburg ...	Malang ...	60,000	1.12	4-5
800	Kalidjeroek ...	Djember ...	6,000	1.25	4-6
800	" ...	" ...	5	7.00	12
200	Mamboel ...	" ...	15,000	} Tapping just beginning	4
200	Glen More ...	Banjoewani ...	5,000		4.0	3½
200	Kaliminger ...	Banjoemas ...	15,000	1.00	4½
260	Pasir Waringen	Bantam ...	24,000	1.25	4-5
200	Tjikadoe ...	" ...	20,000	1.50	4-5

For young trees these results are fairly satisfactory. In several cases tapping had taken place only for 2, 3 or 4 months, and the yield per year is calculated on those monthly returns. At these yields the production per acre of 150 trees is high, especially as they were interplanted with coffee.

COST OF PRODUCTION.

Costs of production f.o.b. Batavia, Soerabaya or other Java ports are comparatively high in view of the fact that no export duty is payable on rubber, and as no Government requirements are enacted in regard to accommodation for coolies or extraordinary expenditure in connection with hospitals or medical attendance. I have inspected the books of various plantations to arrive at a fair average of the cost of producing a pound of rubber during the next few years, and from the information so acquired I have reduced the itemized expenses to the following figures :—

	Cents per lb.	
1. Tapping and Collecting	42	Including 50% depreciation on cups and implements.
2. Curing and preparation	4	Including 20% depreciation on factory and machinery.
3. Transport and Shipping	2	
4. Management	4	Inclusive of commissions to managers and assistants.
5. Weeding	2	
6. Cultivation	3	
7. Manuring	3	
8. Maintenance, roads and drains	2	
9. Depreciation on building, other than factory (20%)	2	
10. Hospital expenses	2	
11. Contingencies	4	Including rent and taxes.

This sum of 70 cents per pound is equal to one shilling and two pence sterling, and represents the minimum average cost f.o.b. for some years to come. The expenditure for tapping and collecting is unduly high, but for reasons already set out it is difficult to see how any substantial economy is to be effected under this heading in the immediate future. As the trees develop a greater yield the cost of tapping and collecting should decrease, but owing to the labour difficulties in Java the reduction in cost will not be nearly so marked as in the case of Malay and Ceylon, where the working conditions are more systematically organised.

ANALYSIS OF EXPENDITURE.

The above estimate of cost of production shows that 80 per cent. is for expenditure on labour. It is clear that in Java the utmost importance must attach to efficient supervision. Together, management and labour amount to 58 cents out of a total expenditure of 70 cents per pound of dry rubber. Therefore, it is clear that on the ability of the manager and his assistants to control the labour efficiently and economically depends the failure or success of the plantation.

CHARGES FROM PORT OF SHIPMENT TO SALE.

The charges from port of shipment Java to London, Rotterdam or Amsterdam differ very slightly from those in force for Malay and Sumatra. The present rate of freight to London is 79 shillings and 5 pence per 50 cubic feet, including the additional (recent) charges on account of the higher price for coal. To Dutch ports the cost of freight is 5 shillings less per ton, the higher rate for London being on account of transshipment in Holland. Rubber from Java is packed in boxes containing 112 lbs., and these average approximately 10 to the 50 cubic feet. Commissions in Europe are similar to those from Malay and Sumatra. The total charges are:—

1. Freight	·83 pence per lb.
2. Rebate to buyer, 2½%, and draft, ½%...	1·50 „ „
3. Brokerage, ½%	·25 „ „
4. Sale charges, insurance, storage, sundries, 1½%	·75 „ „
5. Merchant's commission, 1%	·50 „ „
	<hr/>
	3·83
	<hr/>

These charges are calculated on an average price of 4s. 2d. per pound of rubber.

TOTAL AVERAGE COST PER POUND OF RUBBER.

Adding the cost of production, f.o.b. port of shipment in Java, and the further costs up to date of sale in Europe, the actual total cost is:—

1. Cost of Production f.o.b.	14 pence
2. Freight, Insurance, etc.	3·83 „
	<hr/>
	17·83
	<hr/>

PAST AND FUTURE PRODUCTION.

As regards past production in Java, the amount shipped is insignificant so far as Pará rubber is concerned. The official returns classify Gutta Percha, Rambong and Pará under the same heading, but with some difficulty I have

eliminated the two former, and as a result find that the return of Pará shipments, beginning in 1909, were :—

		Tons.	Acres bearing.		Remarks.					
1909	...	40	...	600	...	About 20 tons to Singapore				
1910	...	70	...	1,000	...	„	40	„	„	„
1911	...	99	...	1,600	...	„	73	„	„	„

ESTIMATED PRODUCTION.

				Tons.				Acres bearing
1912	..	...	...	500	...	...	...	10,000.
1913	...	...	...	1,750	...	...	...	40,000
1914	...	...	...	10,650	...	...	...	158,000
1915	...	...	...	18,300	...	...	...	208,000
1916	...	...	...	26,550	...	...	...	230,000
1917	...	...	...	32,300	...	..	...	230,000
1918	...	...	...	38,250	...	...	...	230,000
1919	...	...	...	43,650	...	...	...	230,000
1920	...	...	...	44,500	...	...	...	230,000
1921	...	...	...	46,000	...	...	...	230,000

The above is calculated on the following basis :—

Age of trees.				Yield per acre.
4 to 5 years	...	...	...	112 lbs.
5 to 6 „	...	...	...	224 „
6 to 7 „	...	...	...	280 „
7 to 8 „	...	...	...	336 „
8 to 9 „	...	...	...	392 „
9 to 10 „	...	...	...	448 „

Taking into consideration that much of the younger rubber has suffered in past years by being interplanted with Liberian coffee and from careless cultivation, from which it is only now recovering, I think this basis for calculating future production is a sound one.

The amount of Rambong (*Ficus*) rubber exported in 1910 was 228 tons; but this dropped off to practically nothing in 1911, for the reason that the high prices of the previous year induced planters to tap the *Ficus* trees heavily, and they have not yet recovered sufficiently to yield any latex worth collecting. The export of Gutta Percha in 1910 was 300 tons, but in 1911 the shipments dropped to 45 tons, the falling off being due to the same cause as occurred with the *Ficus*.

MEANS OF COMMUNICATION IN JAVA.

The railway system is being gradually extended throughout the island, and in the course of a few years will provide access to all the principal districts; but the roads which act as feeders to the various railway lines leave much to be desired. Except in the vicinity of the larger towns the maintenance of all roads and bridges is greatly neglected. First-class Government roads are metalled, but second-class roads have only an earth surface levelled off, and in wet weather are impassable for wheeled traffic. This is especially inconvenient for rubber and coffee estates which, as a rule, are situated at considerable distances from the main roads.

SINGAPORE, 2nd May, 1912.

SUMMARY OF THE CONDITIONS
OF THE
RUBBER INDUSTRY IN THE ORIENT.

SUMMARY OF THE CONDITIONS OF THE RUBBER INDUSTRY IN THE ORIENT.

In dealing with the rubber industry of the Orient a detailed examination has been made in connection with the prevailing conditions of Ceylon, the Malay Peninsula, Java and Sumatra, and a full description of the prevailing conditions is given in the memoranda attached to this report, therefore only a summary of the results of these investigations is now necessary. In view of the fact that the Commissioners did not visit the rubber-producing districts of Africa or South and Central America or Mexico, no attempt has been made to consider the development of the industry in those countries, nor has it been possible to refer to the very important question of present and future consumption of the crude material, owing to lack of definite information on which to base practical calculations. The principal points dealt with in this report are :—

1.—LOCALITY.

The chief centres of the Oriental rubber industry are Ceylon, the Malay Peninsula, Java and Sumatra. To a less important extent plantations have been established in Southern India, Burmah, North Borneo, Dutch Borneo and the Celebes, Saigon, and New Guinea, the Philippines and other islands in Oceania. Investigation in these localities has been confined practically to the cultivation and growth of *Hevea Brasiliensis*, the production of other varieties, such as *Castilloa*, *Ceará*, *Ficus Elastica*, *Jelutong* and other rubber-bearing trees and vines, being insignificant in quantity and value in regard to the supply of the European and American markets for present and future use.

2.—CLIMATE.

Pará rubber demands a hot, moist temperature with an even distribution of rainfall and an equable climate both night and day throughout the year. These conditions prevail to a marked extent in the Malay Peninsula, Java, Sumatra, and to a somewhat lesser extent in Ceylon, Borneo, Saigon and the various great islands of Oceania. In Southern India and Burmah marked divisions of the seasons take place, and the distinctive periods of dry and wet weather are less favourable to rubber cultivation than the more equable distribution of rainfall in the former countries.

3.—AREA.

In 1912, the acreage under cultivation or prepared and ready for planting was :—

COUNTRY.	ACREAGE.
(a) Malay Peninsula	650,000
(b) Ceylon	225,000
(c) Southern India	60,000
(d) Burmah	40,000
(e) British North Borneo and Sarawak	60,000
(f) Java and the Javanese Archipelago	230,000
(g) Sumatra	220,000
(h) Dutch Borneo and the Celebes	10,000
(i) Saigon	25,000
(j) New Guinea, Philippines and other islands... ..	10,000
Total acres ...	1,530,000

Since the above calculations were made the *Times of Ceylon* published figures showing the total area for Ceylon in 1912 to be 234,000 acres. An estimate compiled by the *Straits Times*, and published on March 23rd, 1912, gives the area in the Malay Peninsula in 1911 as 500,000 acres not including Chinese or native holdings, and making no allowance for the large area being prepared for cultivation in 1912, two items amounting in the aggregate to a figure not less than 150,000 acres.

4.—EXTENSION OF THE INDUSTRY.

So far as suitable land is concerned there is no practical limit to the future extension of the cultivated area. In the Federated Malay States the extent of land leased and not yet cleared for plantation purposes is, approximately, 400,000 acres. In view of the fact that rent is being paid for these lands it is reasonable to suppose that a large proportion of them will be opened up in the immediate future. Similar conditions prevail to a modified extent in Java and Sumatra. In fact, the limit of cultivation can only be calculated by the capital available, considerations of the labour supply, and the selling price of rubber in the markets of the world.

5.—WAGE RATE OF LABOURERS.

While the wage rate of labourers varies considerably, as is shown in the memoranda attached to this report, for all broad purposes of calculation and comparison it may be taken as 10 pence or 1 franc per day of 9 hours' work.

6.—LABOUR SUPPLY.

Ceylon draws its labourers from Southern India and the local Singhalese population; Malay from India and China; Sumatra from Java and China; Java from local sources, and Borneo from China. Complaints are heard constantly from planters of a shortage of labour, but the most careful inquiry justifies the statement that taking the industry as a whole there is an abundant supply available, and no serious check is to be anticipated from this cause in the future development of plantations. Nor is there any substantial reason to suppose that a really serious rise in the rate of wages will occur in the immediate future.

7.—PRODUCTION AND EXPORTATION.

After careful consideration of the existing area of the Oriental rubber plantations and the details of the returns per acre gathered from many districts, the following estimate of yields has been prepared :—

YEAR.	MALAY.	CEYLON.	INDIA.	BURMAH.	SARAWAK AND NORTH BORNEO.	JAVA.	SUMATRA.	SAIGON.	TOTAL.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1912	21,000	6,000	600	400	500	500	1,700	300	31,000
1913	36,000	10,000	1,000	700	900	1,750	3,500	700	54,550
1914	43,000	15,000	2,600	2,000	1,800	10,650	8,000	1,200	84,250
1915	63,000	25,000	5,000	3,500	2,500	18,300	12,000	2,000	131,300
1916	80,000	30,000	7,000	5,500	5,500	26,550	16,000	3,000	173,550
1917	97,500	35,000	8,000	7,000	8,000	32,300	22,000	4,000	213,800
1918	113,750	40,000	10,000	7,500	10,000	38,250	33,000	4,750	257,250
1919	130,000	45,000	13,000	8,000	13,300	43,650	44,000	5,500	302,450
	584,250	206,000	47,200	34,600	42,500	171,950	140,200	21,450	1,248,150

This gives a total production of rubber in the Orient of 1,248,150 tons from 1912 to 1919. Sir John Anderson, late Governor of the Straits Settlements, estimates that the production in the Malay Peninsula alone will reach 75,000 tons in 1915, whereas the above estimate only allows 63,000 tons for that year.

8.—COST OF PRODUCTION.

The cost of producing a pound of rubber in the Orient varies with the price of labour and facilities of transport in different localities. Throughout the East a very large proportion of the plantations are in the transition stage of beginning to produce, and consequently, as explained in the attached memoranda, costs are somewhat higher than will be the case in two years from now. At present Ceylon is the cheapest producer, and in many cases the cost f.o.b. has been 8d. per pound, whilst in some shipments it has been as low as 6½d. per pound. In view of all existing circumstances a fair average price f.o.b. for Oriental rubber may be taken as 1s. per pound from the year 1914 to 1919. During the same period the costs from port of shipment to date of sale may be calculated at 3d. per pound, making the average aggregate cost on the market 1s. 3d. per pound.

9.—CAPITALISATION OF PLANTATIONS.

The cost per acre of rubber plantations in the Orient has varied according to circumstances as explained in the accompanying memoranda, but the actual necessary expenditure to bring the trees to the tapping stage should not exceed an average cost of £30 per acre, and in many cases is below this figure.

10.—FUTURE DEVELOPMENT.

In the East the experimental stage of rubber cultivation is now a thing of the past. To what age trees will yield profitably is not yet known, but many fields of 20 years of age continue to give excellent returns, although they have been badly tapped in former years. One tree at Heneratgoda now 36 years old yielded 80 pounds of rubber in 1911 and 81 pounds in 1910.

LONDON, *July 7th*, 1912.

EXTRACT FROM "THE BRITISH NORTH BORNEO HERALD"
DATED 1st FEBRUARY, 1912.

"Some of our Companies are now producers, and I think when I have given you the figures you will agree with me that North Borneo is holding its own, not only in tobacco, but also in rubber. The amount of rubber from our territory sold between November, 1910, and November of this year was, approximately, 113,000 lbs., and realised an average of about 5s. per lb. This does not represent the actual production, for there is still a large amount yet to be sold. The highest average obtained during the period I have mentioned was secured by the Sekong Company, namely, about 5s. 5d. per lb. There are five other producing Companies :--The British Borneo Para Rubber Company, Limited, The Tenom (Borneo) Rubber Company, Limited, The Sapong Rubber and Tobacco Estates, The Beaufort Borneo Rubber Company, Limited, and the Manchester North Borneo Rubber, Limited. The next Company to commence tapping will be the Langkon North Borneo Rubber, Limited. The Manager estimates that 13,500 trees will be tappable in June next. The figures which I have given you speak for themselves, and must be considered highly satisfactory. Reports continue to reach us that the growth of rubber is in many instances phenomenal."—*Chairman's speech at the General Meeting of the Company in 1912.*

SUR DEUX HEVEA DU PARÁ

LE "BRANCO" ET LE "PRETO" SUPÉRIORITÉ DE CE DERNIER.

LE HANCORNIA SPECIOSA.

LENTEUR EXTRÊME DE SA CROISSANCE.

D'APRÈS M. EUGENE POISSON.

Nous avons à maintes reprises signalé, dans ce Journal des observations provenant de sources et de pays différents, tendant à faire reconnaître, parmi les caoutchoutiers de Pará cultivés (*Hevea brasiliensis*, MULL. ARG. = *H. Sieberi*, WARB.) des variétés n'offrant pas toutes les mêmes mérites au point de vue agricole. M. EUGENE POISSON a été l'un des premiers à relever le fait, au cours des deux voyages qu'il fit dans l'Amérique du Sud avant de se consacrer à l'Afrique Occidentale.

Mme. Veuve GODEFROY-LEBEUF veut bien nous autoriser à mettre sous les yeux de nos lecteurs deux figures, publiées dans l'une de ses récentes circulaires et qui montrent l'aspect très différent des deux *Hevea* observés par cet explorateur.

Nous les avons encadrées de deux passages qui s'y rattachent extraits de l'excellent Rapport de M. EUGENE POISSON sur sa mission au Brésil, aux Antilles et au Costa-Rica, publié dans le tome X (1902) des "Nouvelles Archives des Missions scientifiques."

Le premier passage (pp. 7 et 8 du tirage à part), se rapporte au premier voyage, accompli de Février à Juillet 1898, l'autre (pp. 24-25) au deuxième voyage accompli de Décembre 1898 à Octobre 1899. Ce qui y est dit incidemment du Mangabeira, confirme l'appréciation que nous avons donnée de cet arbre dans le chapitre correspondant de notre traduction annotée des Plantes à caoutchouc de WARBURG.

Pour ce qui est de l'*Hevea*, on remarquera que M. POISSON n'ose pas se prononcer sur la question de savoir s'il s'agit de variétés ou d'espèces nettement définies. Le doute ne tardera pas à être levé, la maison GODEFROY-LEBEUF ayant pu se procurer des graines des deux *Hevea*. Grâce à son initiative, ils vont prendre place dans les cultures industrielles ainsi que dans les collections scientifiques. D'ici quelques années, on les verra fleurir et fructifier; on pourra semer les graines recueillies, et on sera définitivement fixé sur la constance et la portée taxonomique des caractères. Voici les termes exacts de la description qu'en donne M. EUGENE POISSON.

"Dans les forêts avoisinant Pará, où je me suis rendu et où j'ai vécu pendant plusieurs jours et à diverses reprises pour assister à la récolte du caoutchouc, j'ai appris des Indiens qu'ils distinguaient deux sortes d'abres qu'ils appellent l'*Hevea* blanc et l'*Hevea* noir, en raison de l'apparence plus foncée de l'écorce et du feuillage de l'un d'eux. Il paraîtrait que le caoutchouc noir donne un latex plus estimé que le blanc et que le mélange des deux formerait un produit supérieur à celui qu'on obtiendrait séparément. Cependant, j'ai la conviction qu'on cherche à éviter la récolte séparée de ces deux latex parce que cela donnerait plus de peine et entraînerait peut-être une moins-value pour la sorte inférieure. S'agit-il ici d'espèces distinctes ou simplement de variétés d'*Hevea*? C'est un point à élucider, qui a été abordé jusqu'alors sans un réel succès et dont il sera parlé plus loin.

“ Les tentatives que j’ai faites pour obtenir des rameaux n’ont été que peu fructueuses. Les seringueiros sont méfiants et croiraient agir à leur détriment en aidant les Européens à se renseigner sur des pratiques qu’ils se soucient peu de faire connaître ; d’autre part, la difficulté d’atteindre le sommet d’arbres élevés est encore un obstacle à vaincre.

“ J’ai dû me contenter de quelques feuilles tombées de ces arbres, dont la floraison est éphémère et capricieuse, et de les conserver en herbar, en attendant une nouvelle occasion de retourner dans ces parages afin de poursuivre ces observations

Et plus loin :

“ Dans la grande île de Marajo, ainsi que dans les autres îles du delta et de la Basse Amazone, y compris les territoires du Xingu et du Tocantin, les seringueiros reconnaissent, dans les Hevea qu’ils exploitent, deux sortes d’arbres dont j’avais déjà parlé dans la première partie de mon rapport de 1898. Je ne puis assurer que ce sont deux espèces ou deux variétés, n’ayant pu, au moment où je me trouvais au Pará, les voir comparativement en fleur et en fruit, mais les organes de végétation sont certainement distincts. Il est possible que ce soit deux races de l’Hevea brasiliensis ; mais, à la simple vue, elles sont différenciées par la couleur de l’écorce, par le port de feuillage et la nuance de celui-ci :

“ 1^o—Le Branco, ou blanc, a les feuilles d’un vert clair, et elles sont tombantes, larges et longues par rapport à la seconde forme, leur sommet est très-acuminé, souvent elles sont tachetées de piqûres d’insectes ; les folioles pendent presque verticalement et le pédoncule commun est également infléchi ;

“ 2^o—Le Preto, ou noir, pousse plus vite et plus droit ; il branche beaucoup plus haut. Sur les jeunes arbres comme sur les adultes, le port du feuillage est différent du Branco. Le pétiole commun est ici plutôt relevé qu’infléchi, et il forme même un coude avec les folioles qui sont encore plus relevées que lui.

“ Je n’ai pas remarqué les taches de piqûres d’insectes fréquentes sur le Branco, et peut-être peut-on attribuer ce fait à une plus grande résistance de l’épiderme.

“ J’ai pris des photographies de ces deux formes d’Hevea.

“ Les seringueiros prétendent que l’Hevea noir a un latex qui coule plus facilement et qu’il est plus riche en caoutchouc que l’Hevea blanc. Il ne m’a pas été possible de contrôler ces assertions, faute de latex suffisant de chacune des deux variétés. Un des avantages de l’Hevea noir serait de prendre plus facilement de bouture que le blanc.

“ J’ai vu un essai de plantation de boutures du Preto de 1 à 2 centimètres de diamètre et de 2 mètres de long, et pas une de ces boutures n’a manqué à la reprise. Cependant, je dois dire qu’il m’a paru que les plants venus de ces boutures n’avaient pas en général la même vigueur que ceux issus de granes.

“ J’ai vu, à la localité de Maguary, quelques Hevea blancs, de 8 ans de plantation et ayant un diamètre de 0m22 à 0m25 sur 9 mètres de haut. Entre Benevides et Benfique, chez un propriétaire italien, M. FREDIANA, se trouve une plantation d’Hevea et d’arbres fruitiers, et personne dans la contrée ne semble la connaître. J’y ai vu, entre autres, 6 Hevea noirs plantés, il y a onze ans et ayant 0m95 à 0m99 de circonférence, à 1 mètre du sol. Ce propriétaire a planté en 1896-1898, sur sa concession près de 5,000 Hevea. C’est un domaine qui vaudra, dans cinq ou six ans 50 à 60 contos.

“ Sur cette même plantation, j’ai remarqué une vingtaine d’arbustes qui donnent le caoutchouc dit de Pernambouc (Mangabeira des Brésiliens, *Hancornia speciosa* des botanistes) dont j’ai parlé dans la première partie de mon rapport. Ces arbustes avaient quatre ans et mesuraient 3 à 5 centimètres de diamètre et 3 à 4 mètres de haut ; ils provenaient de graines venant de Soures dans l’île de Marajo.

“ Je crois que le Mangabeira n’est pas appelé à entrer dans les plantations industrielles. Il sera exploitable au Brésil sa patrie, où l’on ne soigne guère la préparation de son latex en général ; mais ce ne sera jamais un caoutchoutier d’introduction, dans les colonies . . . ”

L’Heva noir (Preto) paraissant être, des deux variétés en présence, la plus intéressante au point de vue économique et aucun collecteur ne pouvant garantir d’une façon absolue la provenance de graines qu’on est obligé de ramasser à terre il est utile citer ce conseil de la circulaire GODEFROY-LEBEUF, à laquelle sont empruntés nos deux clichés :

“ Il est à peu près impossible de distinguer les deux variétés à l’examen des graines, aussi engageons-nous les planteurs à multiplier de boutures les Hevea noirs qu’ils rencontreront dans leurs semis reconnaissables à l’aspect du feuillage.”