THE PLANTATION RUBBER INDUSTRY IN THE MIDDLE EAST

UNITED STATES
DEPARTMENT
OF COMMERCE

TRADE PROMOTION SERIES—No. 2

CRUDE RUBBER SURVEY

THE PLANTATION RUBBER INDUSTRY IN THE MIDDLE EAST

BY

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Special Agent

Fig. 1.—Sir Henry Wickham, the "father" of the plantation rubber industry, standing beside one of the oldest Para rubber trees grown in the East. This tree is in Heneratgoda Botanical Gardens, Ceylon, and was developed from one of the original shipment of seedlings from Kew Gardens, germinated from seeds brought from Brazil by Wickham.

The yields of this record tree were 95 pounds of dry rubber in 1909, 55 pounds in 1910, 67 pounds in 1911, 86 pounds in 1912, and 68 pounds in 1913. Tapping was discontinued in August, 1913, after which date the tree was used as a seed bearer. (By arrangement with the Times of Ceylon)

II

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LETTER OF SUBMITTAL

SIR: There is submitted herewith a report on the Plantation Rubber Industry in the Middle East, by David M. Figart, special agent of the crude rubber section, rubber division. This is the second of a series of publications to be issued on crude rubber; the first, entitled "Marketing of Plantation Rubber," by Special Agent J. J. Blandin, was issued by this bureau as Trade Information Bulletin No. 180 on January 24, 1924. Publications dealing with the possibilities of plantation rubber production in other tropical regions are in process of compilation and will be forthcoming at an early date.

The geographical region dealt with in this report—Ceylon, India, Burma, Malaya, Netherlands India, Indo-China, British North Borneo, Sarawak, Brunei, Siam, and the Pacific Islands (data on British Borneo having been supplied by Messrs. Vance, Muzzall, and Bushnell, of the Philippine survey party, and a detailed discussion of the Palembang and Djambi districts of Sumatra by Mr. Muzzall)—produces 95 per cent of the rubber of the world. The economic factors surrounding the industry in this territory are discussed, with special emphasis on cost of production and the extent to which the future potential output from the present planted area can be depended upon to meet the world's increasing demand.

This report also brings out the material reduction in costs effected during the last few years through adoption of altered methods, and indicates the possibility of additional important savings by further reorganization. This is of interest in connection with the department's survey in the Philippines and Latin America, because in these countries there exists the possibility of avoiding unnecessary expenditures as shown by past experience, as well as of departing somewhat, as local conditions permit, from the present field methods which are more or less standard in the East.

The field work on this report occupied the period from June, 1923, to February, 1924. It is therefore possible that new information has become available since Mr. Figart's visit to the various countries. It is believed, however, that there is no probability of the major premises or conclusions being upset by fresh data in the near future. Such export figures as have since appeared (and which are included in the Introduction) bear out this view.

Late in 1924 arrangements were made between British and Dutch planting interests for a joint investigation of the native cultivation of rubber in the Middle East, hence more reliable information on this point should soon be available.

Respectfully,

JULIUS KLEIN, *Director*.

To Hon. HERBERT HOOVER,
    Secretary of Commerce.

FOREWORD

Our rubber imports in 1923 were valued at $185,000,000, or about 72 per cent of the whole world's production. Crude rubber ranked fourth among our imports, only raw silk, sugar, and coffee exceeding it in value. Three great industries are dependent upon the raw material—rubber manufacturing, automotive, and oil (through its dependence upon the automotive industry). The aggregate capital invested in these industries exceeds $13,000,000,000.

On March, 1923, the Department of Commerce was instructed by Congress "to investigate and report on the possibilities of developing the rubber-plantation industry in the Philippines and Latin America"; under the same appropriation, it was instructed to "investigate the conditions of production and marketing of other essential raw materials for American industries."

These investigations had become peculiarly necessary, due to the very general tendency abroad to form combinations for the control of production and prices of many materials which we do not ourselves produce and for which we are dependent upon imports. The investigations so far conducted have disclosed such combinations in sisal (for binder twine), potash, nitrates, coffee, tannins, and other materials.

These foreign combinations require careful consideration, to the end that we may find means to stimulate competitive production as well as to provide measures by which our consumers may set up such counter action as will protect them.

Since 1905 a constantly diminishing share of the world's demand has been met by wild rubber, until in 1923 more than 93 per cent of the total supplies came from planted areas in the Middle East. Of the total acreage of plantation rubber Great Britain controls 69 per cent through domicile in British colonies, and a total of 75 per cent through domicile in British territory and British ownership of plantations in Netherlands India. Opposite this centralized production in the hands of one nation is centralized consumption, for the United States, due to the enormous number of motor cars in use, regularly consumes more than 70 per cent of all the rubber produced.

As a result of an overproduction of rubber and unprofitable prices therefor in 1921 and 1922, a restrictive law upon exports was applied in the British possessions, effective November 1, 1922.

The measure, known as the Stevenson Restriction Act, was one of the actions which called the attention of the American public to their

dependence upon one distinct region mainly under control of one
government for a commodity so essential to our national welfare.
We should consider the possible effect upon ourselves.

The possible result of such action in restraint of production and
distribution is of twofold order: First, its effect upon price; second,
its effect upon present and future exports and therefore upon our
future supplies.

It requires from four to six years for rubber trees to come into bear-
ing. The preparation and planting of new rubber plantations in the
Middle East has been greatly retarded by the unfavorable market
conditions. Although there is some planting antedating the restric-
tions which is yet to come into bearing, the stifling of planting by
unprofitable years bids fair to result in a world shortage after a few
years. A careful investigation into the future world demand for
rubber undertaken by the Rubber Association of America with the
cooperation of the Department of Commerce indicates that this short-
age is likely to be felt by 1928 or 1930, and may lay a heavy burden
on the American consumer.

The producing industries of the world would be much better off in
the long run if combinations in restraint of international trade were
abandoned on all sides. In general, their effect is to hoist both the
producing and the consuming industries upon artificial bases, ulti-
mately resulting in economic difficulty to producers as well as con-
sumers. The stifling of consumption, stimulation of rival production,
the use of substitutes, and the paralyzing of industry generally are
their ultimate results.

HERBERT HOOVER,
Secretary of Commerce.

MAP SHOWING PRINCIPAL COUNTRIES
WHERE PLANTATION RUBBER IS GROWN

(THE PERCENTAGE WHICH EACH COUNTRY HAS OF THE
TOTAL AREA PLANTED IS INDICATED BY THE FIGURES
IN CIRCLES)

INDIA

CEYLON

BAY OF BENGAL

BURMA

SIAM

GULF OF SIAM

FRENCH INDO CHINA

BRITISH MALAYA

SINGAPORE

SUMATRA

DUTCH BORNEO

BRITISH NORTH BORNEO

CELEBES

CHINA SEA

PHILIPPINE ISLANDS
(U.S.)

Fig. 2

VICEROY

INDIA
In
Council
Lieutenant
Governor
with Legislative
Council
BURMA

HIGH COMMISSIONER
Native Rulers,
Federal and State
Councils
British Residents
Native Rulers
with
British Advisers
and Agents
Native Ruler
with
British Resident

MALAY STATES
Federated | Unfederated
Selangor | Johore
Perak | Kedah
Negri Sembilan | Kelantan
Pahang | Trengganu
| Perlis

BRUNEI
(BORNEO)

GOVERNOR
Who is also
Executive
and
Legislative
Councils

STRAITS SETTLEMENTS
Singapore
Penang
Malacca
Prov. Wellesley
Dindings
Labuan

BRITISH AGENT
Governor
in Borneo
Court of Directors
in London
Independent
British
Rajah

BRITISH NORTH BORNEO
SARAWAK

GOVERNOR
With Executive
and
Legislative
Councils
CEYLON

GOVERNOR
With Colonial Council
COCHIN CHINA
FRENCH COLONY

GOVERNOR GENERAL
With Legislative
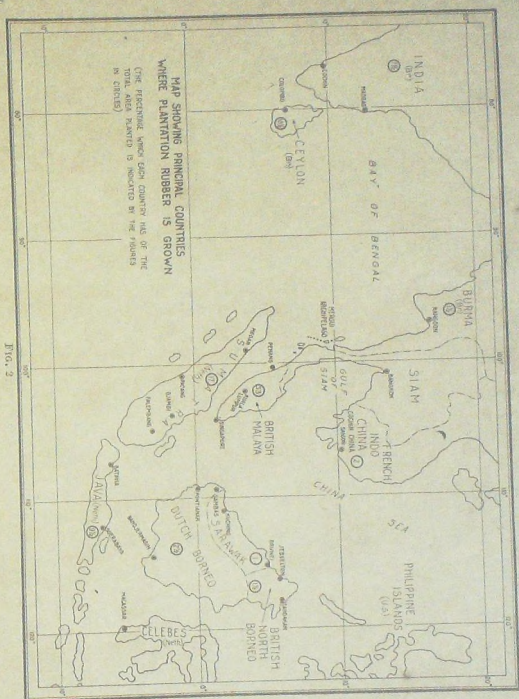and Advisory Councils
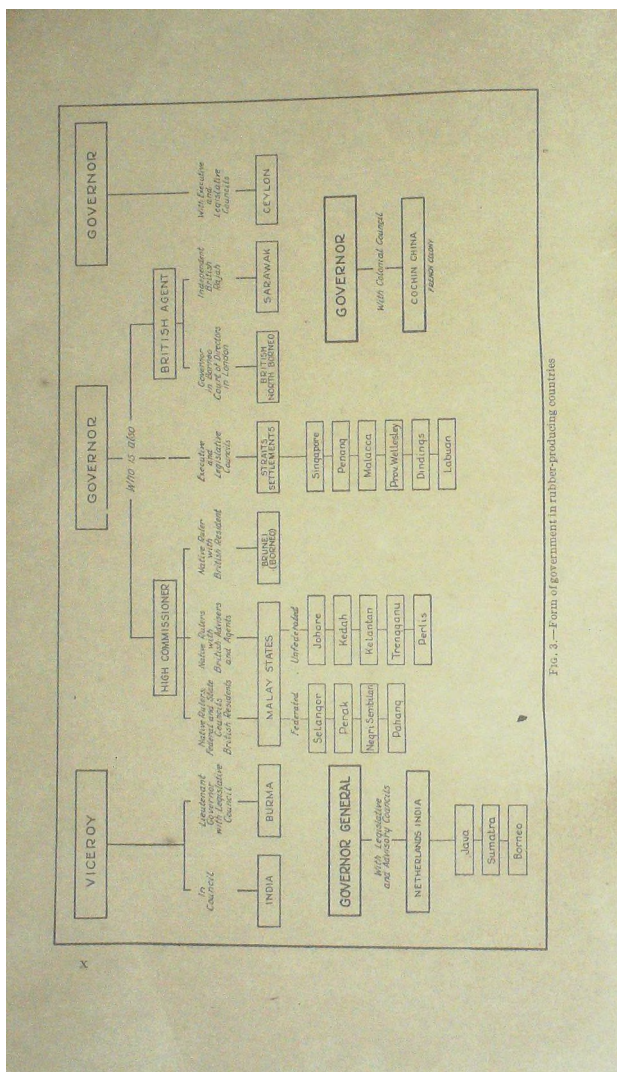NETHERLANDS INDIA
Java
Sumatra
Borneo

Fig. 3.—Form of government in rubber-producing countries

THE PLANTATION RUBBER INDUSTRY IN THE MIDDLE EAST

INTRODUCTION

The plantation rubber industry in the Middle East originated from seeds of *Hevea brasiliensis*, otherwise known as Para rubber, collected in Brazil by Sir Henry Wickham in 1876, germinated in Kew Gardens, London, and sent from there to the East. Other rubbers such as Castilloa (*Castilla* spp.), Ceara (*Manihot glaziovii*), and Rambong (*Ficus elastica*) are not dealt with in this report, as they have practically disappeared from cultivation.

Figure 2, page ix, shows the location of the plantation-producing countries of the Middle East, together with the acreage percentage contributed by each. It will be noted that 69 per cent of the acreage is domiciled in British possessions (British Malaya, Ceylon, India, Burma, and British Borneo), 29 per cent in Netherlands India (Sumatra, Java, and Dutch Borneo), and 2 per cent in the French colony of Indo-China.

DISTRIBUTION OF AREA

Table A shows the acreage planted in the different States and the area tappable at the present time. Figure 4 presents the planted-area data in graphic form.

TABLE A.—AREA PLANTED AND TAPPABLE,[1] TOTAL MIDDLE EAST

Countries	Total area planted [2]	Area tappable [3]
	Acres	*Acres*
Ceylon	445,000	423,000
India and Burma	124,000	119,000
Malaya	2,275,000	2,061,000
North Borneo, Sarawak, and Brunei	117,000	87,000
Total British	2,961,000	2,690,000
French Indo-China	86,000	68,000
Netherlands India	1,249,000	1,092,000
Total other	1,335,000	1,160,000
Total Middle East	4,296,000	3,850,000

[1] Includes both European and native-owned rubber.
[2] To end of 1923.
[3] In 1924; 5 years old or over.

This table shows the total planted area in British territory (Ceylon, India, Burma, Malaya, North Borneo, Sarawak, and Brunei) to be 2,961,000 acres. In addition British-owned plantations in Netherlands India aggregate 269,000 acres; making 3,230,000 acres, or 75 per cent of the total planted area of the Middle East, under British control.
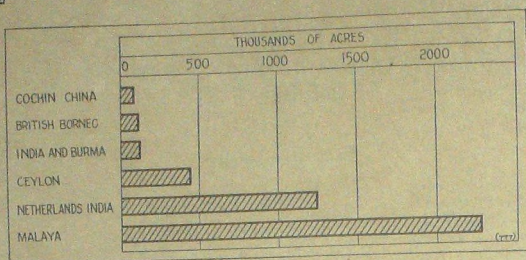
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Fig. 4.—Geographical distribution of the area planted

PLANTATION PRODUCTION

Table B shows the production (net exports) of plantation rubber from the different countries of the Middle East, with the percentage contributed by the British colonies. The quantities represent long tons of 2,240 pounds—the "ton" used throughout this report unless specifically stated otherwise. Figure 5 gives the total exports in diagram form.

TABLE B.—PRODUCTION (NET EXPORTS) OF PLANTATION RUBBER, TOTAL MIDDLE EAST

| Years | British possessions | | | | | Netherlands India | French Cochin-China | Grand total Middle East | British share of grand total |
	Ceylon	British Malaya	India and Burma	British Borneo	Total British				
	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Tons	Per cent
1905	70	104			174			174	100
1906	145	432			577			577	100
1907	250	905			1,157			1,157	100
1908	390	1,402		4	1,796			1,796	100
1909	681	2,698		7	3,386			3,386	100
1910	1,522	5,713		34	7,269			7,269	100
1911	3,061	10,895	332	95	14,383			14,383	100
1912	6,628	20,540	643	277	28,088	2,025		30,113	93
1913	11,325	33,213	1,040	608	46,186	5,535		51,721	89
1914	15,336	46,430	1,343	883	63,992	8,970	191	73,153	87
1915	21,787	70,516	2,161	1,631	96,095	17,811	371	114,277	84
1916	24,334	97,837	2,781	3,058	128,010	30,443	540	158,993	81
1917	32,290	134,788	3,992	4,312	175,382	44,880	916	221,187	79
1918	20,665	107,691	4,377	4,193	136,926	43,345	529	180,800	76
1919	45,010	199,545	6,554	6,375	257,484	88,189	2,901	348,574	74
1920	39,532	174,322	6,376	5,851	226,081	75,522	3,068	304,671	74
1921	39,342	151,000	5,306	5,311	200,959	72,227	3,560	276,746	73
1922	46,694	212,280	4,854	7,081	271,589	102,171	4,472	378,232	72
1923	37,111	183,812	6,417	10,094	237,434	137,158	5,146	379,738	63
1924 [1]	37,338	152,320	7,161	8,208	205,027	175,298	6,378	386,703	53

[1] Estimated; subject to later revision.

This table shows that during recent years the proportional percentage of plantation rubber furnished by British territory has been decreasing gradually as other producing regions come into bearing. The reduction of the exports of the British possessions from 72 per cent of the total for the Middle East in 1922 to 63 per cent in 1923 and to an estimated 53 per cent in 1924 was due to the restriction on exportation imposed by the British Colonial Office. During the

last two years increasing quantities of wet native-plantation rubber have been shipped from Netherlands India, most of which went to British Malaya and was there remilled before reshipment to consuming markets. Also, the net exports of British Malaya are determined by subtracting the imports (largely wet rubber) from the gross exports. If allowance were made for moisture in native rubber, the figures for British Malaya would be higher and those for Netherlands India lower than those shown in the table; also the percentages coming from British colonies would be increased accordingly.

BRITISH RESTRICTION ON EXPORTS

The cumulative effect of an increasing production of crude rubber and a decreasing world demand therefor during the years 1920–1922 brought about a crisis in the industry, the price having fallen in New York to an average of about 16 cents and a minimum of 11½
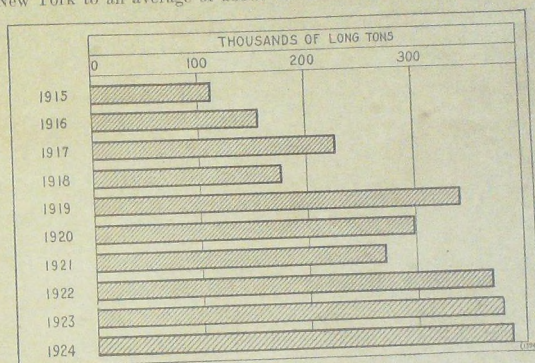

Fig. 5.—Exports of plantation rubber from the Middle East

cents a pound in 1921. Various attempts were made by producers to reduce output by voluntary cooperation; these failing, finally a legislative restriction upon the exports of rubber from British possessions was recommended by the Stevenson Committee appointed by the British Colonial Office.

This restriction act became law November 1, 1922. It provided for a "standard production" for each rubber estate, based on actual output of that estate for the year ending October 31, 1920, plus an allowance for production from new areas. A certain percentage of the total standard production was allocated for exportation in each quarter-year, depending on the average price of rubber during the preceding quarter. For the first three months during which the restriction act was in force exportation was set at 60 per cent of the total standard production. An average price of 1s. 3d. to 1s. 6d. (roughly 30 to 36 cents) during a stated quarter would bring about the release of an additional 5 per cent of the standard production; an average price of 1s. 6d. to 1s. 9d. (about 36 to 42 cents) would

result in the release of 10 per cent. Inversely, if the price should average less than 1s. a pound during a 3-months period, a reduction of the percentage of release by 5 per cent was provided for the following quarter.

Reference to Table B will show that there has been no appreciable difference in the exports of the Middle East of 1922, 10 months of which were without legislative restriction, and those of 1923 and 1924, with restriction in effect in the British colonies, the totals being respectively 378,000, 380,000 and 386,000 tons. The loss due to restriction in exports from British Malaya and Ceylon is counterbalanced by increased production in Netherlands India. Had the British colonies produced and exported to their capacity in 1924, it is estimated that 100,000 more tons would have reached the markets of the world during this year from this source.

EFFECT OF RESTRICTION ON PRICES

The following table gives the average quarterly price of ribbed smoked sheet in New York from the first quarter of 1915 to the closing quarter of 1924:

TABLE C.—AVERAGE NEW YORK PRICE FOR RIBBED SMOKED SHEET

Years	Average price per pound			
	January–March	April–June	July–September	October–December
	Cents	Cents	Cents	Cents
1915	65½	61½	60½	68⅜
1916	88½	71½	59	69¼
1917	81	79½	66⅜	59⅝
1918	56⅛	65¼	61½	55½
1919	53¾	45	43½	52¼
1920	50¾	40¼	30	19⅛
1921	18⅝	15½	14⅜	17⅝
1922	16	15½	14½	23⅝
1923	34⅛	29⅛	28	26⅝
1924	24½	20½	24¾	34½

The above table shows that up to the last quarter of 1920 the average quarterly price did not fall below 30 cents a pound, and that the drop from that time coincided with the general depression in business and the consequently reduced demand for rubber.

DEPLETION OF STOCKS ON HAND

During the depression, and until restriction went into effect on November 1, 1922, the average quarterly price of rubber was below 20 cents, and a minimum price of 11½ cents was touched in June and July, 1921. The date of the adoption of restriction happened to coincide with an improvement in business, and both together forced the price of crude rubber up to over 25 cents for the year 1923, the maximum price reached being 37⅛ cents; the average price during the first quarter of 1923 was 34⅛ cents. Shipments of rubber from world producing centers during 1923 were less than world consumption, and the difference was made up by drawing on the accumulation of stocks of dealers and manufacturers which had been piled up during the business depression.

During the first part of 1924 a temporary slackening in the rubber manufacturing industry resulted in the price for the first three quarters averaging between 20 and 25 cents and in May rubber sold as low as 17⅜ cents. The sharp recovery in business in the fall, together with the still further depletion of stocks, carried the price near 40 cents at the end of December.

The world's stocks have now been reduced to a dangerous minimum,[1] and this condition, together with greatly increased activity in rubber manufacturing in both the United States and Europe, has forced the price up to a higher level than has been the case since the business depression began in the latter part of 1920.

WORLD PRODUCTION

The following table shows the world production (net exports) of both plantation and wild rubber from 1905 to 1923, by amount and per cent:

TABLE D.—WORLD PRODUCTION, PLANTATION AND WILD RUBBER

Years	Total plantation	Total wild (tropical America and Africa)	World production		
			Total	Plantation	Wild
	Tons	Tons	Tons	Per cent	Per cent
1905	174	a 59,320	59,494	0.3	99.7
1906	577	62,004	62,581	.9	99.1
1907	1,157	66,013	67,170	1.7	98.3
1908	1,796	64,770	66,566	2.7	97.3
1909	3,386	70,370	73,756	4.6	95.4
1910	7,269	73,477	80,746	9.0	91.0
1911	14,383	68,446	82,829	17.4	82.6
1912	30,113	73,834	103,947	29.0	71.0
1913	51,721	63,280	115,001	45.0	55.0
1914	73,153	48,052	121,205	60.4	39.6
1915	114,277	54,740	169,017	67.6	32.4
1916	158,993	51,086	210,079	75.7	24.3
1917	221,187	56,751	277,938	79.6	20.4
1918	180,800	36,711	217,511	83.1	16.9
1919	348,574	50,424	398,998	87.4	12.6
1920	304,671	36,464	341,135	89.3	10.7
1921	276,746	23,903	300,649	92.0	8.0
1922	378,232	27,878	406,110	93.1	6.9
1923	319,738	b 36,685	b 406,423	93.4	6.6
1924 b	386,703	28,000	414,703	93.2	6.8

a Excluding Venezuela. b Estimated.

The above table shows the growing importance of plantation rubber over wild rubber. The peak of production of wild rubber was reached in 1912, when nearly 74,000 tons were exported—71 per cent of the world total for that year.

In 1914, the production of plantation rubber for the first time exceeded that of wild, constituting 60 per cent of the total net exports, which aggregated 121,205 tons. In 1923, 93.4 per cent of the total of 406,000 tons was plantation and 6.6 per cent wild. Reduction

[1] Published information gives the stocks on hand in the United Kingdom at the close of 1924 as 29,500 tons, the lowest on record since the end of August, 1920, and a decrease during the year of nearly 31,000 tons. Stocks in the hands of dealers and manufacturers in the United States at the same date amounted to 57,700 tons, a decrease of about 19,000 tons during the year—or 50,000 tons for these two countries alone. It is difficult to estimate the consumption of rubber for 1924 at this time, but from information on file in the Bureau of Foreign and Domestic Commerce it would appear likely that world consumption for the year will reach at least 475,000 tons and total exports from producing centers possibly 415,000 tons. (See Table D.) Consumption in the United States for 1924 has been placed by reliable commercial authorities at 335,000 tons, against 305,000 tons for 1923, an increase of 30,000 tons.

in the amount of wild rubber exported occurred during the war, mainly in Africa. A more decided reduction in the amount in both Africa and tropical America was felt when the price of rubber fell sharply as the result of the general business depression in 1921.

OWNERSHIP OF PLANTED AREA

Of the total area planted in the Middle East two-thirds are owned by European and American capital. There has been a steady though gradual increase in the percentage owned by natives.

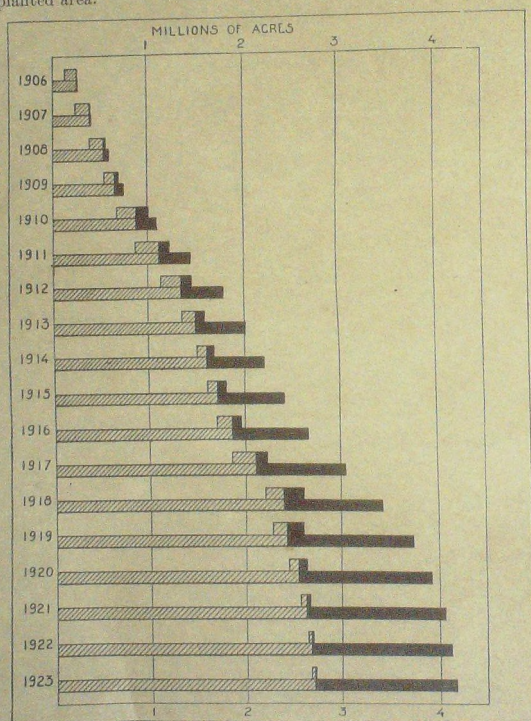Figures 6 and 7 trace the growth of relative ownership of the planted area.

Fig. 6.—Area planted with rubber. The hatched bar denotes European-owned rubber; the shaded bar, native-owned. The superimposed bars show the amount of planting done each year
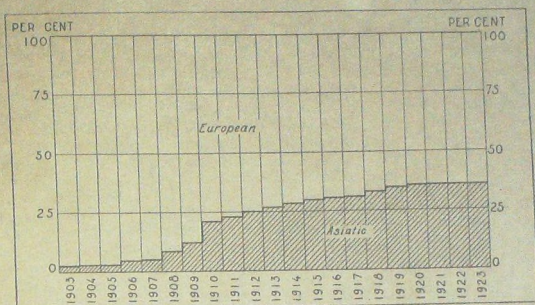
PER CENT
100
75
50
25
0

European

Asiatic

PER CENT
100
75
50
25
0

1903 1904 1905 1906 1907 1908 1909 1910 1911 1912 1913 1914 1915 1916 1917 1918 1919 1920 1921 1922 1923

Fig. 7.—The shaded portion shows the percentage of the total planted area owned by Asiatics (natives and Chinese)

COST OF PLANTING

There are as many variables in the cost of planting and maintaining an acre of rubber to the producing stage in the Middle East as there are in apple orchards over different parts of the United States. The purchase price of land, the density of tropical jungle to be cleared, the investment in buildings and equipment, variations in wages and in the efficiency of the different races, and a score of minor items enter into any estimate. For well-managed, foreign-owned estates in the Middle East, the cost to-day of planting and maintaining an acre of rubber to the producing stage would vary from $150 to $325 U. S. currency, to which must be added interest during the growing period. With interest included, the cost would probably range between $200 and $400 per acre.

COST OF PRODUCTION

In production costs also there is great divergence. Location, yield per acre, cost of labor, health conditions, efficiency, and management all vary over a wide field. Moreover, available costs present much difficulty in comparison because of difference in accounting methods and in the items included as to overhead, selling costs, depreciation, amortization of the life of the plantation, etc. Furthermore, years of low prices make for economy, perhaps some of it at the expense of the future; while years of high prices stimulate extravagance.

The average f. o. b. cost (Middle Eastern ports) for 1922 (a year of severe economies) of 129 estates in Ceylon, Malaya, and Netherlands India was 12.7 cents U. S. This does not include amortization, head-office, shipping, marketing, and some other costs. Again, the published average all-in cost for 1922 of 13 Ceylon companies was 13.4 cents U. S.; for 60 Malaya companies, 15.1 cents; for 18 Netherlands India companies, 17.4 cents; and for 12 Borneo companies, 16.5 cents. This included freight, insurance to consuming markets, and head-office expenses.

RELATION OF YIELD TO COST

While the foregoing figures are quoted in "cost per pound," it was found in analyzing costs that "operating cost per acre" was the better basis upon which to work in most instances. "Cost per pound" varies with the yield per acre, while "operating cost per acre" should be approximately the same, given similar topographical and labor conditions, regardless of the yield. This being true, the larger the yield per acre the lower the production cost per pound.

Where the planter's general aim is to conserve his young growth by protection against disease and overtapping, a yield of 400 pounds or more per acre can be reached by the time the trees are 10 years old and maintained for a number of years thereafter, provided soil and climatic conditions are favorable. There are large acreages, however, where the physical conditions are much less favorable, and on such the 400-pound-yield stage can not be reached. Moreover, the nonconservation of young growth against overtapping and disease is likely to result in yields below 400 pounds for mature plantations and in shortening their producing life.

RETURN PER POUND

A careful analysis of the items making up costs, with what is believed to be an adequate allowance under all headings, for the delivery of rubber to the consuming markets, including amortization but excluding profit taxes, corporation taxes, and bonuses, seems to indicate that fairly well managed plantations with an output of around 400 pounds per acre would be covered by a realization of 16 to 17 cents U. S. per pound, delivered in New York, and these costs might be lowered by larger-unit operations. Favored plantations would earn small profits within such a return; these include (a) estates where the yields are more than 400 pounds per acre and (b) those favored with good management, location, and labor supply that yield at least 400 pounds, or less than this amount if conditions are exceptionally good.

The additional return necessary to yield a stimulative profit of, say, 15 per cent on capital invested in such well-managed plantations would amount to $7\frac{1}{2}$ cents a pound for the comparatively few plantations with a capital cost as low as $200 U. S. per acre and 15 cents for plantations with a capital cost of $400 U. S. per acre. The larger class, consisting of those plantations whose capital costs range between $200 and $400 per acre, would, of course, net a return of between $7\frac{1}{2}$ and 15 cents. With such profits for the well-managed and well-situated lands, even the marginal lands (that is, those in less favorable position as regards location, yields, management, etc.) would give some return on the investment made in them.

CAPITAL INVESTMENT

Following is an approximation of the capital invested in rubber plantations in the Middle East and its origin, stated in American currency:

Great Britain	$505, 000, 000	Denmark	$11, 000, 000
Netherlands	130, 000, 000	All other, including	
France and Belgium	30, 000, 000	native-owned areas	112, 000, 000
Japan	42, 000, 000		
United States	32, 000, 000	Total	876, 000, 000
Shanghai	14, 000, 000		

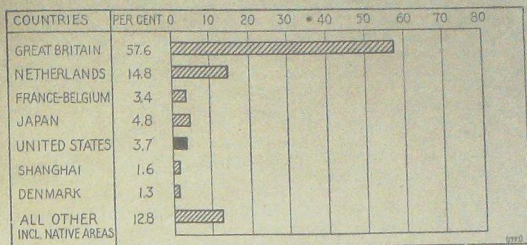| COUNTRIES	PER CENT 0	10	20	30	•40	50	60	70	80
GREAT BRITAIN	57.6								
NETHERLANDS	14.8								
FRANCE-BELGIUM	3.4								
JAPAN	4.8								
UNITED STATES	3.7								
SHANGHAI	1.6								
DENMARK	1.3								
ALL OTHER INCL. NATIVE AREAS	12.8								

FIG. 8.—Relative investment of European, American, Japanese, and native capital in rubber plantations

EARNINGS OF PLANTATION COMPANIES

The financial history of a number of companies was traced back to 1909. In that year figures were compiled for 17 companies; this number was gradually increased to 52 in 1922. During the greater part of this period prices ruled at a high level; on the other hand, much of the area was immature or had not reached the full-bearing stage. Over this 14-year period an annual average profit of 26 per cent on the issued capital was earned. The issued capital (which averaged over, rather than under, the actual capital spent) was earned three and a-half times.

Dividends averaging 22 per cent per year were paid—over three times the issued capital. The number of companies paying dividends during the depression is of interest: In 1920, 21 out of 51; in 1921, 22 out of 51; in 1922, 46 out of 51.

Figure 9 traces the variation in issued capital, net profits, and dividends over the period 1909–1922.
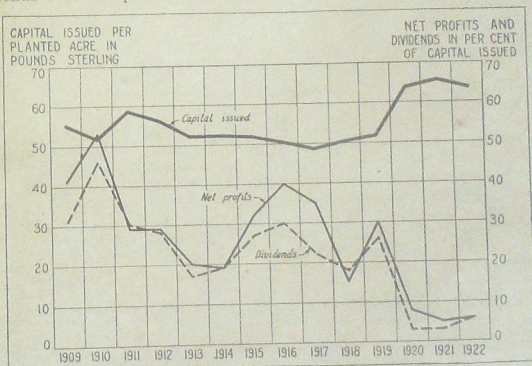

FIG. 9.—Financial history of plantation rubber companies, as indicated by the average capital issued per acre, profits earned in per cent of capital issued, and dividends paid in per cent of capital issued

FUTURE POTENTIAL OUTPUT OF THE MIDDLE EAST

In view of the rapid increase in the world consumption of rubber some forecast of the potential future production from this, the greatest rubber-producing area, is of importance. This production will depend in the main upon three factors:

(a) Acreage now planted but not yet in bearing.
(b) Future planting.
(c) Governmental restrictions on output.

Rubber is not an annual crop. It requires from 4 to 6 years to come into bearing and from 10 to 12 years to reach the so-called full-bearing stage.

Table A shows that out of approximately 4,300,000 acres planted in the Middle East about 3,800,000 are of tappable age, and, subject to other conditions, the output could be expected to expand at least in this proportion. Owing to the fall in price in 1920, due to a slackening in the world demand, with a consequent oversupply, there has been comparatively little planting undertaken during the last three years. Calculation of future potential output, based on the assumption of full exports and the maturity of the present planted areas, would indicate approximately the following:

TABLE E.—ESTIMATES OF FUTURE POTENTIAL OUTPUT OF PLANTATION RUBBER FROM PRESENT PLANTED AREA, TOTAL MIDDLE EAST

Years	Tons	Years	Tons
1924	507, 500	1928	613, 000
1925	551, 600	1929	617, 000
1926	584, 000	1930	621, 000
1927	602, 000		

By "potential output" is meant the quantity of rubber the Middle East could produce from the present planted area with restriction removed and with ample labor and superintendence available. It is highly improbable that the potential output shown above could be reached for several years, were estates free to produce to capacity, because of the difficulty of securing an adequate labor supply. The estimates are thought to be generous.

FUTURE WORLD CONSUMPTION

With the above table, however, must also be taken into consideration the probable course of world demand. An estimate of future consumption or a forecast of demand and of market conditions can not be attempted by the Department of Commerce, which can concern itself only with existing facts. Nevertheless, an exhaustive study of the probable consumption of rubber during the next few years was undertaken by the Rubber Association of America, which publishes the following estimates: [18]

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[18] See pages 5 and 24, and Chart 6 on page 23 of "Analysis and Forecast of the World's Rubber Consumption and Comparison with Production and Stocks Annually to 1930," by Ray B. Prescott, prepared and distributed by the Rubber Association of America (Inc.), May, 1924.

TABLE F.—FUTURE POTENTIAL WORLD PRODUCTION AND CONSUMPTION AS ESTIMATED BY RUBBER ASSOCIATION OF AMERICA

Years	Crude rubber (plantation and wild)	
	Estimated world production	Estimated world consumption
	Tons	Tons
1924	531,000	505,000
1925	574,000	540,000
1926	606,000	575,000
1927	623,000	608,000
1928	633,000	641,000
1929	637,000	672,000
1930	641,000	703,000

Concerning the figures given above, the author, Mr. Prescott, states:

In forecasting, there is to be expected nearly always some variation from the normal or calculated figures giving the most probable results. With this in mind all users of this report should make allowances for probable variation of about 10 per cent from these forecasts of rubber consumption. Or, in other words, these figures can be assumed as correct within a probable variation of 10 per cent, except under unusual conditions.

Because of restriction in British possessions, the 1924 exports of plantation rubber from the Middle East will fall far-short of what those regions could have produced without restriction. The consumption of rubber in this year, conservatively estimated at 475,000 tons, is well within the 10 per cent variation allowed for by the statistician and much above the exports from the producing regions.

The greatest variable in the estimated production figures given in Table F is wild rubber. The probable production of wild rubber has been included at an average of about 20,000 tons a year. Under the stimulus of high prices, somewhat larger quantities of rubber from wild areas may be expected, thus delaying the time when consumption will have overtaken production. However, only a substantially higher price could force the production of wild rubber to double the estimated 20,000 tons. The potential production of wild rubber is very great, but increased quantities must come from areas so inaccessible that they can be profitably exploited only when crude rubber is bringing a very attractive price in the world market.

I. SUMMARY

GENERAL PLANTING SUBJECTS

Rubber requires a warm, moist climate, with deep soil of good physical texture. A rainfall of 70 inches is sufficient; over 120 inches is considered high. Sixteen hundred feet is generally regarded as the highest altitude for rubber, though there are some good estates at a higher elevation. Provided soil conditions are right, a dry season of several months does not necessarily rule out a country for planting. Districts with winds of cyclonic force and frequent morning rains should be avoided.

The rubber districts of the Middle East lie mainly in a belt 10° north and 10° south of the Equator; in this region temperature and rainfall are suitable and destructive winds practically unknown..

PLANTING METHODS

The approved planting methods at the present time are clean clearing and removal of all timber and stumps; close planting—about 200 trees per acre—with early thinning out, eventually to 70 or 80 trees per acre; and conservation of soil and rainfall on slopes by terracing, digging of pits, construction of bunds, cover crops, etc. Certain soils may not require clean clearing.

Where competent scientific advice is available, budded stock and selected seed may be used as planting material. The theory is that this system presents three chances for high yields—(a) bud grafting to reproduce high yielders, should it prove successful; (b) seed selected from high-yielding trees; and (c) a large number of trees per acre from which to select the highest yielders, the remainder being removed. While good results are eventually expected from bud grafting and seed selection, these matters are still very much in the experimental stage, and it can not be said that there is as yet any proven method of developing specially high yielding strains.[b]

Crops interplanted in rubber to help defray capital expenditure are not regarded with favor, mainly because of the uncertainty of a market for them. Cultivation, forking, plowing, etc., have not been considered necessary. Fertilizing has not resulted in any apparent increase in crop except in isolated instances where especially poor soils were encountered; it is believed, however, to have had a beneficial influence indirectly, by maintaining the trees in health and vigor and perhaps preventing a falling off in yield.

TAPPING PRACTICE—NEW PROCESSES

Tapping systems have undergone a complete change during the past three years. Daily tapping has been generally replaced by alternate-day tapping or periodic tapping (tapping daily for a period and resting for a period). The almost universal limit is one cut per

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[b] Latest reports from the East are to the effect that budded stock from proved strains is now used on some new areas, with 150 trees to the acre. Where sufficient budding material is not available, selected seed are planted 400 to the acre, as it has been found that experimental tapping for individual yield records can be carried out before the trees interfere.

tapping—usually on half the circumference, but sometimes on one-third, one-quarter, or one-sixth. There is no finality about tapping systems; they are still in the experimental stage.

Important new developments in the preparation of plantation rubber have been introduced recently. These are chiefly shipment in liquid form and spraying (Hopkinson process). Should these or similar methods prove permanent, they may result in the scrapping of a great part of present plantation factory equipment.

ECONOMIC LIFE OF A RUBBER TREE

There is insufficient evidence on which to base deductions regarding the economic life of a rubber plantation. It is known that plantations which have received proper treatment will have a longer economic life than those which have been abused; but the life of the best-cared-for plantations can not be definitely stated, and it is accordingly necessary to figure on sooner or later replacing all rubber trees on the plantation. There is a gradual but certain tendency for directors to provide for this contingency, either by small annual extensions to their present planted area, if reserve land is available, or building up an amortization fund on the basis of a 30 or 35 year life. However, no prophecy can be ventured regarding the life of an estate planted on good soil and properly cared for from its start.

NATIVE RUBBER

The question of native-grown rubber—that is, rubber grown on plantations owned by the local non-European population, including Chinese—has been the most difficult met with during the investigation. One-third of the planted area is controlled by this class of producers. Most of it receives extremely bad treatment; and after careful inquiry and observation the conclusion has been reached that some of it will disappear altogether, some of it will remain practically equal in quality to European-owned areas, and most of it will show declining yields. As a compensating factor, many natives are reported to be still extending their areas.

The competition which European-owned estates will suffer from native-owned plantations can not be measured by cost of production, because no comparable cost can be assigned to native plantations; nor can it be measured by checking exports of native-grown rubber against price, because it is not known how much marketing facilities may have to do with declining exports during low prices. Marketing facilities may have an increasing influence on native-plantation production, especially as consumers' standards for the raw product become increasingly severe.

The estimated amount of capital invested in the average European acre (£55) is four times as high as the native (£14). Assuming the same yield per acre, this means that the native owner can earn as large a return on his investment as the European owner with one-fourth the profit per pound of rubber; but it is doubtful if the native owner ever thinks in terms of "return on investment" or "cost per pound."

Some students of the situation fear that control will eventually pass into the hands of the natives. Whether or not the present organization and administration of the European industry are strength-

ening the position of the native plantations is a subject well worthy the attention of producers. The situation must be met on economic, not legislative, grounds.

It seems fairly clear that native-owned rubber will become a factor of more and more importance in stabilizing the industry, because of the comparative ease with which native producers can cease producing rubber during low prices and divert their attention to other crops, or, on the other hand, concentrate on rubber production during high prices by adopting more intensive tapping methods than would be countenanced by Europeans.

RELATIVE MERITS OF VARIOUS COUNTRIES

Comparatively little land suitable for rubber is left in Ceylon and Java. Malaya, Sumatra, Cochin China, and Borneo have large areas still available, though transport facilities have not been developed in some districts.

The initial cost of leasing land in the various countries is approximately as follows:

Malaya.—From $25 Straits up to $100 (roughly $12.50 to $50 U. S. currency); average probably $40 (about $20 U. S. currency) per acre.

Sumatra.—From 10 guilders up to 50 guilders ($3.60 to $18 U. S. currency), depending on whether secured directly from the Government or native rulers, or purchased from concession-holders; average generally placed at 25 guilders ($9 U. S. currency) per acre.

Borneo.—No premium is chargeable.

In all countries except Netherlands India land is available by outright purchase or grant in perpetuity. In Netherlands India land is given out in some districts on leasehold for 75 years, and in others on concession for 75 years, with renewal for 50 years.

Land rent ranges up to $4 Straits ($2 U. S.) per acre in Malaya, up to 3 guilders per hectare ($0.43 U. S. per acre) in Sumatra, and up to 1.20 piasters per hectare ($0.24 U. S. per acre) in Cochin China. Ceylon has no land rent, and in Java it ranges up to 5 guilders per bouw ($0.21 U. S. per acre). In Borneo no rent is charged for the first 6 years; for the next 4 years a rent of 50 Borneo cents ($0.25 U. S.) is charged, and $4 Borneo ($2 U. S.) thereafter.

Generally speaking the soils of Malaya, Sumatra, and Cochin China are very suitable for rubber cultivation; Java and Ceylon have suffered from previous cultivations, soil wash, etc., but some areas are very good. Parts of Borneo are well adapted to rubber. Due to superior climatic and soil conditions, it is thought that the average yield of European rubber will be higher in Malaya and Sumatra than elsewhere. Cochin China may equal it, but in any event will be a close second. Individual estates in Ceylon and Java are very good, but the average over all will probably not be so high as in Malaya. Burma and South India estates will show the poorest averages. Four hundred pounds per acre is a good average for mature rubber.

CLIMATIC CONDITIONS

Of the Middle Eastern countries, Malaya, Sumatra, and Borneo have the most suitable rainfall as regards both amount and distribution. The high and unevenly distributed precipitation of Ceylon,

South India, and Burma creates conditions favorable to the development of bark diseases and to abnormal leaf fall, from which these countries suffer. Java is subject to occasional droughts of more or less severity. The rainfall of Cochin China is light and unevenly distributed, but the droughts appear to have no serious effect on total output, probably due to soil conditions.

Table 1 below and the accompanying diagram (fig. 11, p. 16) illustrate typical rainfall of various countries (for Borneo rainfall data see p. 213).

TABLE 1.—TYPICAL RAINFALL, MIDDLE EAST

Countries	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
Ceylon (Kalutara)...	6.1	4.5	7.7	13.6	21.7	16.7	9.8	9.3	12.4	21.0	17.5	10.5	150.8
India (Koni)	.4	1.2	3.6	8.1	11.6	25.6	24.2	9.8	10.1	20.2	11.8	2.0	128.6
Burma (Mergui)......	1.0	2.1	2.9	5.5	17.5	29.5	31.9	29.6	26.8	12.2	3.8	.4	163.2
Malaya (Kuala Lumpur)........	6.4	6.2	8.5	10.4	8.7	5.0	4.3	6.6	7.1	11.1	9.9	9.6	93.8
Sumatra (Kisaran)¹.	5.3	3.3	3.6	5.2	6.4	4.9	5.1	7.5	8.2	11.3	8.1	7.8	76.7
Java (Siragar).......	12.0	12.0	13.0	15.0	10.0	7.0	6.0	6.0	7.0	14.0	15.0	13.0	132.0
Indo-China (Loc Ninh)...............		1.1	.4	2.8	10.5	10.8	13.9	13.5	14.1	10.0	3.4	2.8	83.3

¹ The figures for Kisaran show a typical monthly distribution, but the amount of precipitation is somewhat below the average for the rubber districts of Sumatra.

POLITICAL SITUATION AND LABOR LEGISLATION

The social and political unrest in India and other Eastern countries during the World War, and for a short period afterwards, gave much cause for concern to the governments in control. The situation has steadily improved within the last year or two, and there does not seem to be cause for alarm at present; but certain leaders of the native masses are continually making demands which, if not judiciously handled, may prove serious.

The labor legislation controlling emigration which was recently enacted in India was said to have been inspired partially by political motives. Malaya and Ceylon had anticipated the majority of the provisions of this legislation by previous enactments, and little difficulty was experienced in meeting the additional demands. Failure of the monsoon means starvation in South India; any attempt to interfere with the steady flow of Indian labor to Malaya and Ceylon, which has taken place for many years, must deal first with the economic pressure on the population that has been the cause of emigration. China and Indo-China apparently have no political problems at present, so far as their effect on the labor supply is concerned.

Java has no special labor legislation. Legislation in Sumatra, Malaya, Ceylon, Borneo, and Cochin China is similar in character; but the expenditure incumbent on estates through the operation of the labor laws varies considerably in the different countries. The Sumatra legislation is the most exacting; Ceylon, Malaya, and Borneo have a somewhat broader interpretation of the laws as regards both employer and employee; and Indo-China has the most lenient regulations, especially as to housing, sanitation, etc.—designed, no doubt, to aid planters in opening up the country.
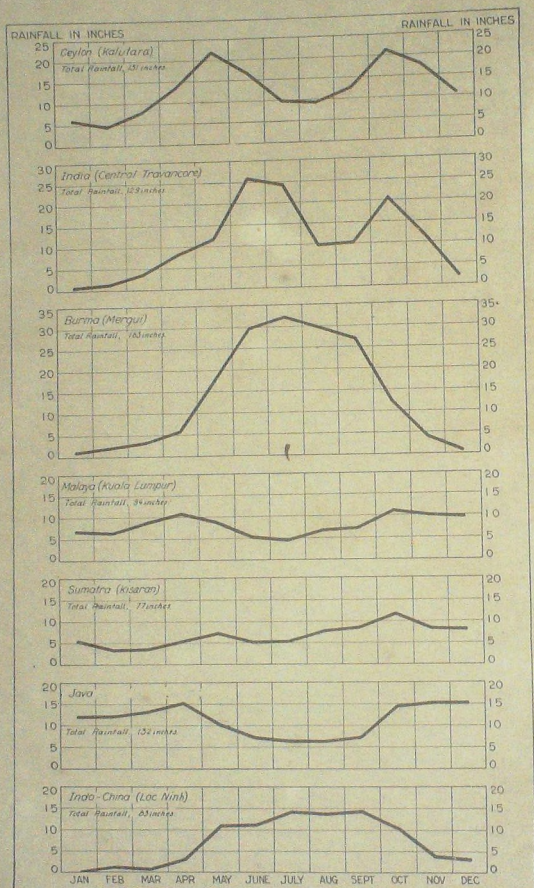
Fig. 11.—Monthly rainfall distribution in countries where plantation rubber is grown (typical stations)

LABOR SUPPLY AND TURNOVER

The labor situation is briefly as follows:

Ceylon and Burma are dependent on India for their plantation labor. The future prospect is for an ample supply unless political disturbances in India stop emigration; this is unlikely.

Malaya looks to India and China and in future could probably get sufficient Chinese labor to replace Indians if emigration from India were interrupted.

Sumatra depends for plantation labor on Java, where there is an ample supply under indenture.

Java has its own labor supply, which is ample save for occasional temporary, seasonal shortages.

Indo-China also has indigenous labor. Cochin China recruits in other parts of Indo-China, so that if the demand for labor is unusually heavy a shortage might develop temporarily.

Borneo is dependent on China and Java for the bulk of its labor, but employment of local labor is increasing.

Though some information is given on labor turnover in several of the reports on individual countries, the figures may be misleading for the following reasons:

1. During the depression of 1921 and 1922 much labor was discharged and repatriated, and recruiting was largely discontinued.

2. New labor legislation in various countries may so alter conditions in future that past experience will be no guide.

3. Turnover depends very largely on the ability of the management to handle labor, the sanitary condition of the estate, and its reputation in recruiting centers.

Comparison between countries is difficult; but the turnover is unquestionably least in Sumatra and Cochin China (and probably Borneo), with indentured labor; greater in Ceylon; possibly still greater in Malaya; and probably greatest of all in Java, with free indigenous labor.

WAGES AND COST OF RECRUITING

The basic wages of the various countries, with conversion into United States currency at par and at approximate current rates of exchange, are given below:

TABLE 2.—WAGES PAID TO ESTATE LABOR

Countries	Basic wages	Equivalent in American currency—	
		At par	At current rate [1]
Ceylon	60 rupee cents	19.5 U. S. cents	18 U. S. cents.
Malaya	40 Straits cents	22.7 U. S. cents	20 U. S. cents.
Sumatra	50 guilder cents	20.1 U. S. cents	18 U. S. cents.
Java	45 guilder cents	18.1 U. S. cents	16 U. S. cents.
Indo-China	40 piaster cents	28.4 U. S. cents	20 U. S. cents.
Borneo	50 Borneo cents		25 U. S. cents.

[1] Approximate current rate of exchange in April, 1924.

The cost of recruiting a Javanese laborer for service in Sumatra is 135 guilders (about $48 U. S.). A few Javanese are employed in

Malaya, Borneo, and Cochin China. The recruiting cost for Cochin China, landed on the estate, is 85 piasters ($43 U. S.), or less than for Sumatra. Tonkinese recruits for Cochin China cost on an average about 35 piasters, or roughly $18 U. S. currency. Chinese for Borneo cost $100 Borneo currency ($50 U. S.), and Javanese cost about $130 Borneo currency ($65 U. S.).

In Ceylon and Malaya, recruiting itself costs nothing, as the planter is reimbursed from a common fund for his expenditure in recruiting labor. Sometimes he makes a profit. However, he pays an assessment into the common fund; this varies in amount, depending on the condition of the fund, but, broadly speaking, his recruit probably costs him $15 U. S. currency, including the assessment as an indirect charge.

EFFICIENCY OF LABOR

Generally speaking, indentured labor is the most efficient; this is due not only to the enforcement of the contract stipulations, but also very largely to the improvement in the physical condition of the laborer, resulting from better food and proper medical attention.

From the standpoint of hours of work, Cochin China and Sumatra head the list with their indentured labor. Indian labor in Malaya is less efficient than Javanese in Sumatra; one authority said there was a difference of 50 days' work per laborer per year between Sumatra and Malaya. There is little to choose between Malaya, Java, and Ceylon; Malaya may have slightly the advantage. Java estates may suffer temporary shortage during the rice-harvesting season and during periods of high prices for native produce.

As regards the type of labor, Indian is the most easily handled. The Indian laborer saves money to remit home. Chinese, under the contract or piecework system, where a gang leader or contractor undertakes a job of work for a fixed price, are the most industrious but are usually more expensive, especially in times of labor shortage. They are a very thrifty people. The Javanese is a good worker, if handled properly, but is improvident. Cochin China planters, with experience in Malaya and Netherlands India, say Tonkinese and Annamite labor is the best of all.

No comparison is possible on the point of health. Bad health, principally malaria, is usually encountered anywhere when opening up jungle land; some districts are undoubtedly worse than others, but this can only be learned from experience.

COMPARATIVE COSTS OF PRODUCTION

The relatively high cost of labor, direct and indirect, in Sumatra and Malaya is offset by high yields. Cochin China has low indirect labor charges. Borneo wages are fairly high, but there are compensating advantages in the terms under which land is obtained.

Topography has an influence on costs of tapping, as illustrated by the following approximate average tapping tasks: Cochin China, 450 trees; Malaya, 400 trees; Sumatra, 400 trees; Java, 350 trees; Ceylon, 200 trees.

The former low labor costs in Ceylon are offset by low tasks, expenditure on fertilizing, and, latterly, increasing expenditure due to new labor legislation. The low labor costs in Java are offset by a lower average yield, lower tasks, and occasional shortages of labor.

There are compensating factors in all the rubber-producing countries, which show a trend, at the present time, toward a general equality in costs of production. The chief qualification to this statement is future taxation in Netherlands India.

TAXATION

Cochin China is in a good financial position. Ceylon and Malaya are both financially strong and economically administered. Netherlands India is handicapped by high taxes and an unbalanced budget.

Cochin China has no taxation. Ceylon and Malaya have modest export taxes, which, so far as can be seen, are not likely to be increased materially. Netherlands India taxes (income, profit, and export) are on the sliding-scale principle; they are under revision at the present time. Most Borneo estates are free of taxation for 50 years.

The accompanying diagram (fig. 12, p. 20) gives six comparisons:

(a) Present Netherlands Indian taxation with present Malayan taxation.

(b) Present Netherlands Indian taxation with former Malayan taxation.

(c) Netherlands Indian taxation as proposed by Colonial Commission with present Malayan taxation.

(d) Netherlands Indian taxation as proposed by Colonial Commission with former Malayan taxation.

(e) Netherlands Indian taxation as proposed by Holland Commission with present Malayan taxation.

(f) Netherlands Indian taxation as proposed by Holland Commission with former Malayan taxation.

The diagram shows that the latest tax-revision proposals—that is, those of the Holland Commission—are much more favorable to rubber cultivation than both the present taxes and the taxes proposed by the Colonial Commission. The native-grown rubber is not bearing its share of taxation.

EXCHANGE

The country with a silver currency is always confronted with the possibility of high costs through a rise in silver. This is what occurred during the unprecedented rise of 1919–20. The rupee more than doubled in terms of sterling, and the piaster nearly trebled in terms of United States currency. Malayan and Netherlands India currencies were more stable.

In normal times the rupee (India, Ceylon, Burma), the Straits dollar (Malaya), and the Borneo dollar (British North Borneo) are maintained at a fixed rate with sterling and will therefore fluctuate only in relation to the cross rate. Stabilization of the rupee has not yet been reestablished. Some fear is expressed regarding the future course of the Netherlands India guilder or florin (Sumatra, Java, Dutch Borneo) due to the heavy indebtedness of the colonies. The piaster of Indo-China is liable to the widest fluctuation so long as it is so closely related to silver. The Indo-China Government has under consideration methods for stabilizing its currency.
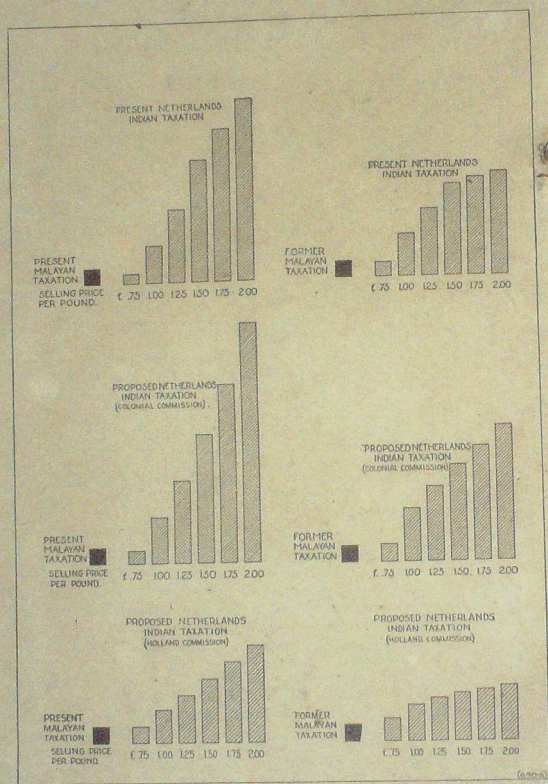
Fig. 12.—Comparison of present and proposed Netherlands Indian taxation with present and former Malayan taxation

II. PRODUCTION ILLUSTRATED

Photographs of Operations in the Production of Plantation Rubber, from Clearing of the Jungle to Shipment of the Product

FIG. 13.—The majority of estates have been developed on land formerly under forest growth (jungle). This photograph shows typical virgin jungle
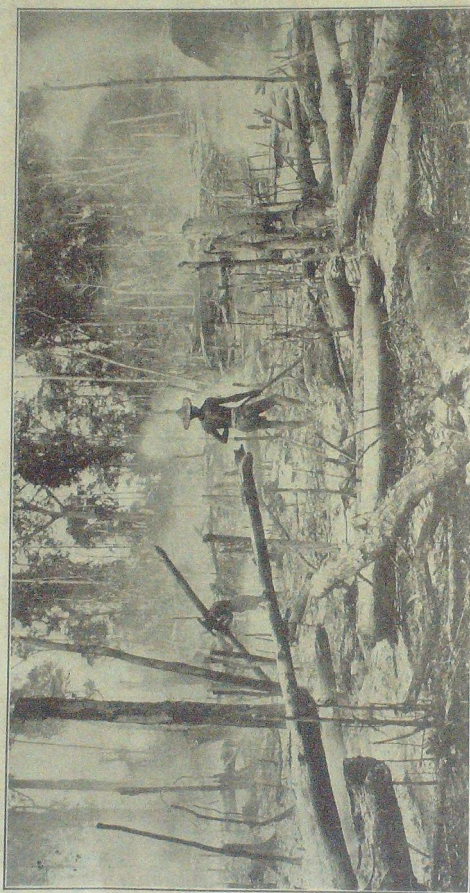
FIG. 16.—Chinese laborers clearing after a burn

Fig. 17.—Land on which jungle has been felled and burned and first chunkolling completed. A chunkol is a tool similar to a hoe, except that it has a larger and heavier blade. It is used to dig out roots and turn under top soil.
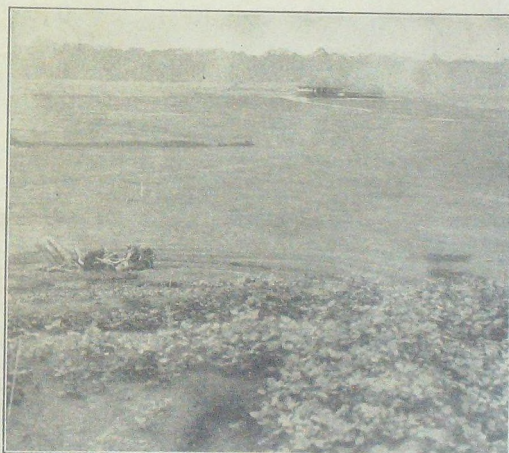
Fig. 18.—"Clean clearing" (see p. 104). Land cleared and ready for planting. The foreground is a close-up view of a terraced hill with cover crops planted to prevent soil erosion during heavy rains

FIG. 20.—Terracing
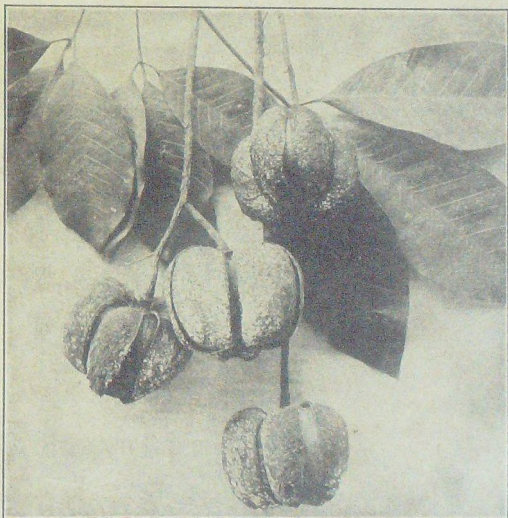
FIG. 21.—The rubber tree comes from a so-called "seed," which is mottled brown in color, similar to a chestnut, but somewhat larger; it is inclosed in a hull or pod, as illustrated in the photograph. This cracks open and the seed falls to the ground. The leaves and pods in the photograph are a little less than half the actual size
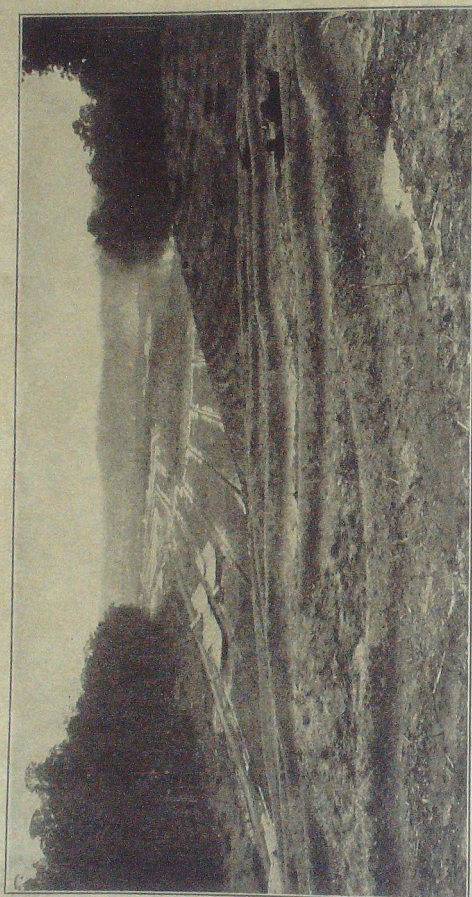
Fig. 10.—A new clearing. In the foreground is shown a system of "contour bunding" and on the hill to the right a system of "terracing." The object of contour bunding and terracing is to prevent loss of soil from heavy tropical downpours of rain and to retain water and permit it to percolate into the soil. In the center of the photograph is shown a system of dist-land drainage. On the extreme right and left is typical eastern jungle
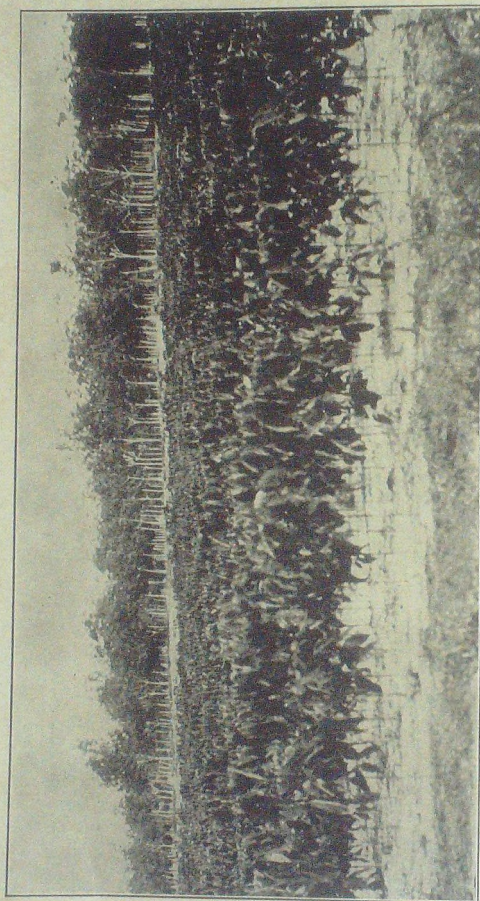
FIG. 22.—Selected seeds are germinated in a nursery or planted directly in the field. This photograph shows a nursery, from which the young trees are transplanted to the field either by removing each tree individually, with its roots inclosed in earth by means of a rough basket, or by cutting off the limbs and roots and transplanting as "stumps."

FIG. 23. — Young rubber trees (planted 1922) on a flat-land estate, showing drainage system. Old rubber in front of jungle in the background

FIG. 24.—Clean-weeded immature rubber. Tapping begins about the fifth year, when the trees attain a girth of approximately 20 inches at 3 feet from the ground
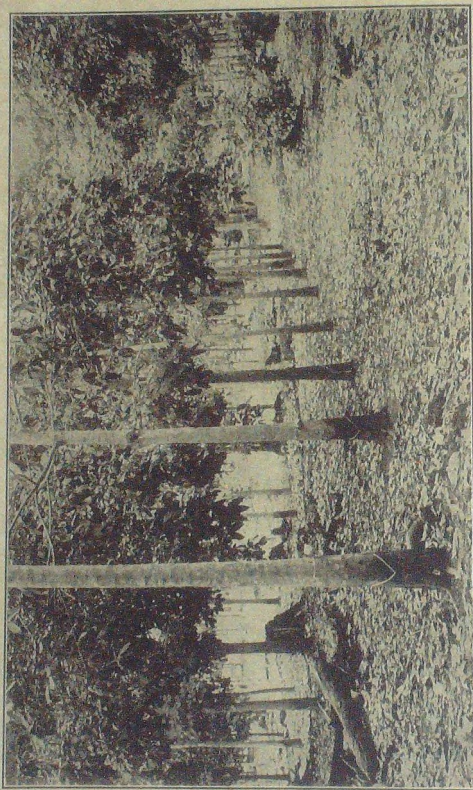
FIG. 20.—Mature rubber trees being tapped by the "basal V" system. A year's consumption of bark is represented by a vertical panel from 6 to 12 inches in length on alternate-day or periodic tapping. Logs and stumps similar to those observed in the photograph are breeding places for root diseases in certain types of soil

Fig. 26.—A Javanese woman tapping. Tapping consists of removing a very thin shaving of bark with a tapping tool shaped like a chisel, gouge, or farrier's knife. The tapping period is from daylight to about 9 a. m.

Fig. 27.—Pouring the latex from the porcelain cup into the collecting pail. The latex is collected after tapping is completed and is usually in the estate factory by noon
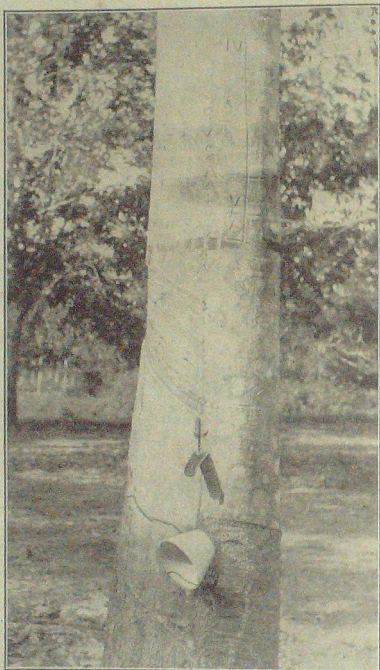
Fig. 28.—A small galvanized iron spout is driven lightly into the bark to direct the flow of latex from the fresh cut into the porcelain cup. After the latex is collected the cup is turned on its side in a wire holder, in order to keep it clean for the next tapping operation.

The darker sections of bark to the right of and below the cup are areas which have been previously tapped and are renewing; when the renewed bark is 6 to 10 years old, it can be tapped again

The characters on the tree near the top of the photograph show the yielding capacity of the tree, as determined by periodical measurements of the quantity of latex received per tapping. Trees are selected as "mother" trees for budding material, for seeds, or for removal according to these yield records

Fig. 30.—Bud grafting. Binding the bud in place with paraffined cloth

Fig. 29.—Bud grafting. A section of bark is loosened from the tree and the bud inserted underneath. The bark is then replaced in position and the whole bound with paraffined cloth, as shown in Figure 30. After the bud sprouts the young tree is cut off above the junction

Fig. 31.—Bud grafting. An area of budded rubber 6 months old. The tree in the foreground shows how the young shoot is growing from the original stem, which has been cut off. The junction will practically disappear in time. The theory of budding is that the tree developed by this process will reproduce the high-yielding characteristics of the mother tree from which the bud was obtained
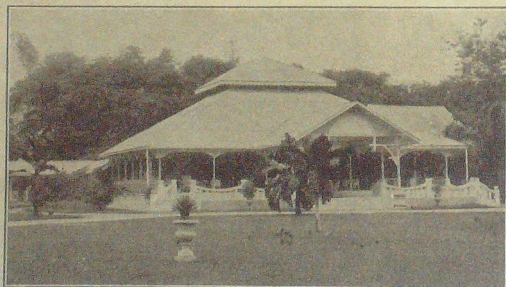
Fig. 32.—A head manager's bungalow
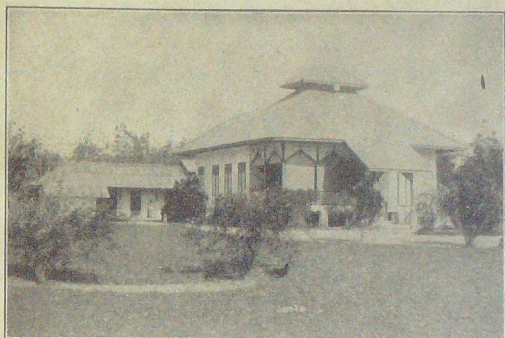
FIG. 33.—Assistant manager's bungalow
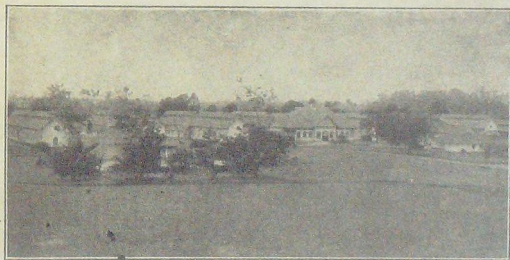
FIG. 34.—Central hospital of a large group of rubber estates
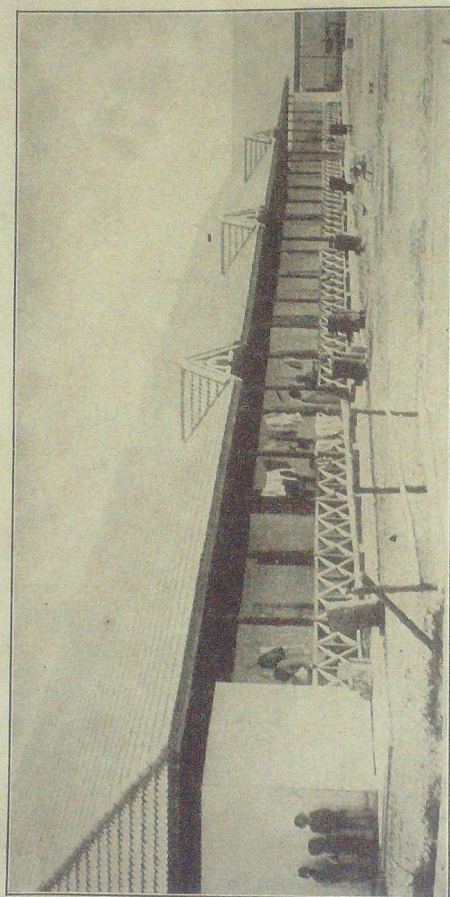
FIG. 36.—Laborers' quarters. Each building is designed to house approximately 50 people and is divided into rooms about 8 by 10 feet. Preparation of meals generally takes place in special outdoor kitchens
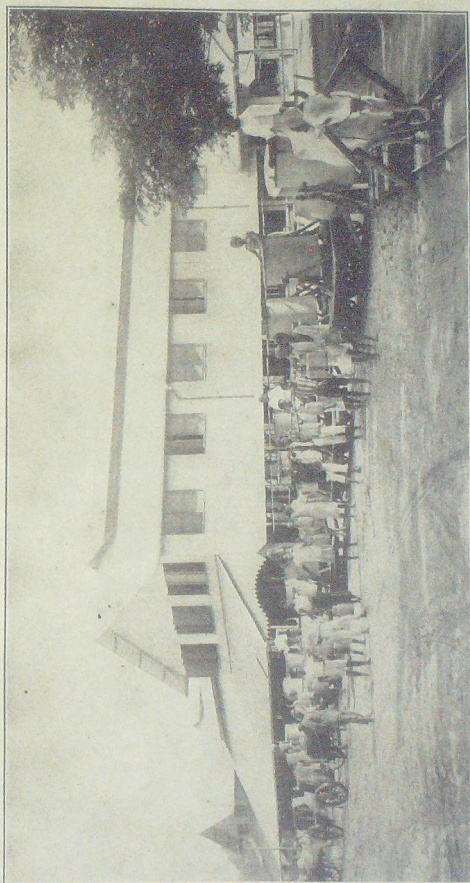
FIG. 36.—Estate factory, showing latex being brought in by hand, by bullock cart, and by light railway
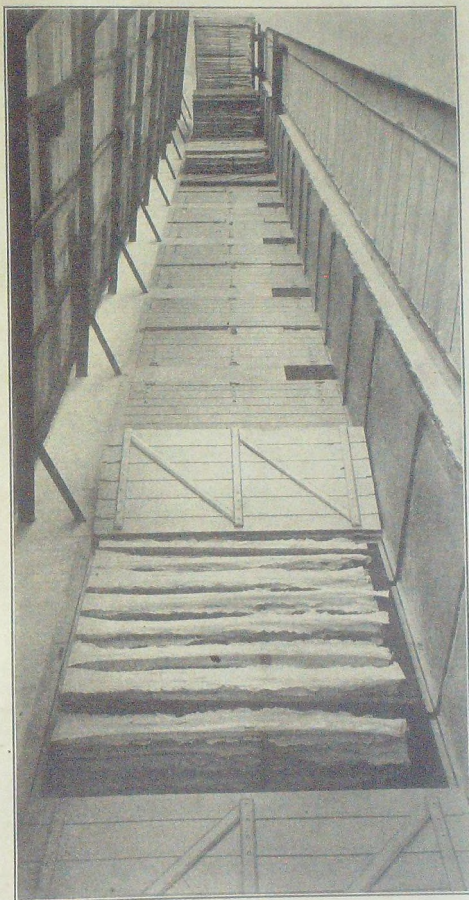
FIG. 40.—Drying shed. This photograph shows the method adopted by some estates to transport rubber from the milling room. The sheets are hung on a framework on wheels, which is moved into the drying shed
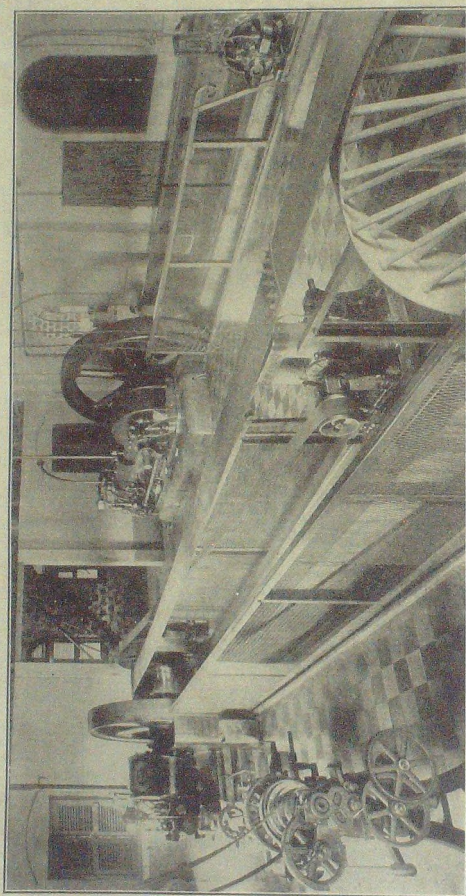
Fig. 39.—Power plant of rubber-estate factory
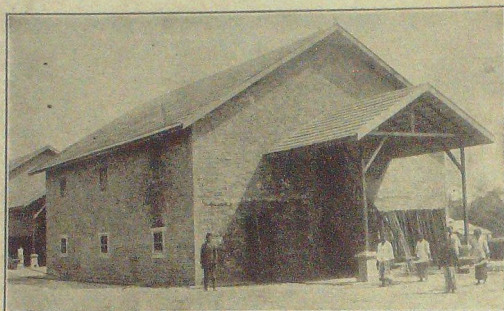
Fig. 41.—Estate smokehouse, where "smoked sheet" is cured
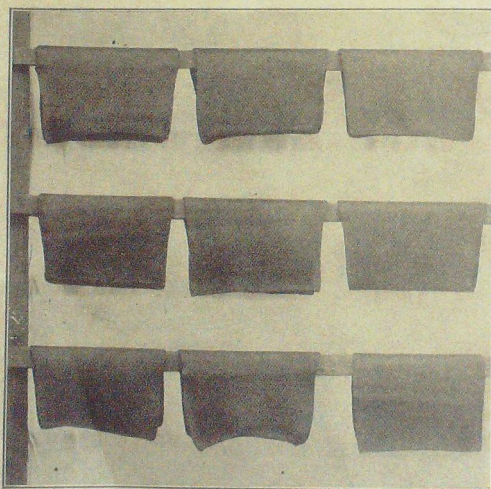
Fig. 42.—First-quality latex is prepared in two forms, "pale crêpe" and "smoked sheet." The photograph shows the latter grade
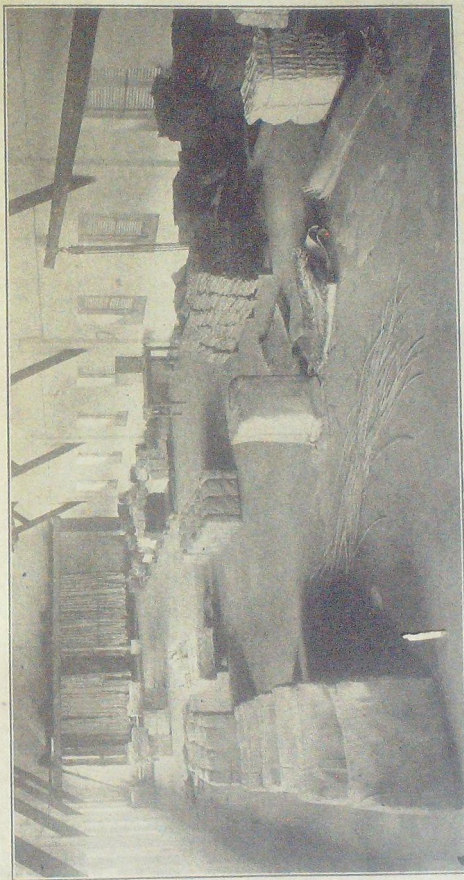
FIG. 41.—Packing room. Pale crêpe (first latex) and brown crêpe (off grades) being packed for shipment to consuming markets. Baling is shown in this photograph, but most of the rubber shipped from the East is packed in wooden boxes (see fig. 44)
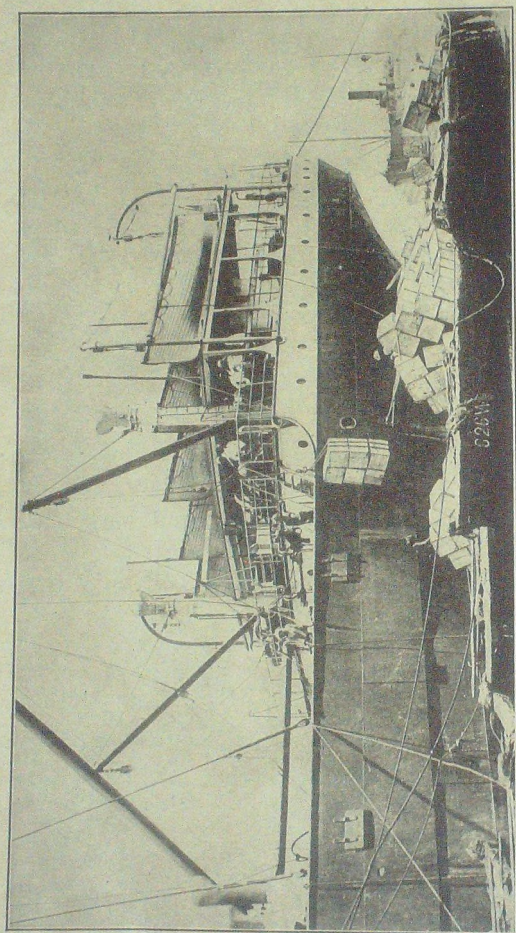
FIG. 44.—Loading cases of rubber
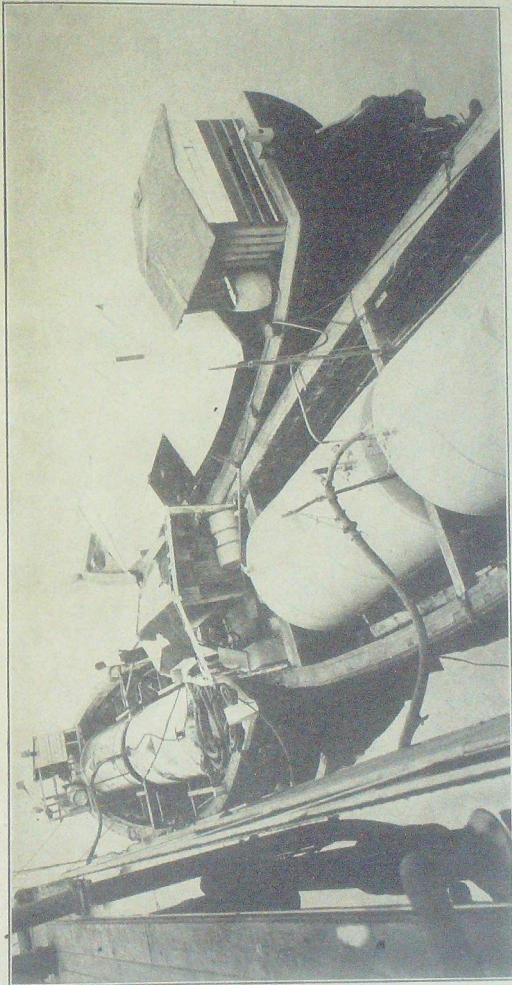
Fig. 45.—Pumping latex from tank lighters into steamer tanks for shipment to New York
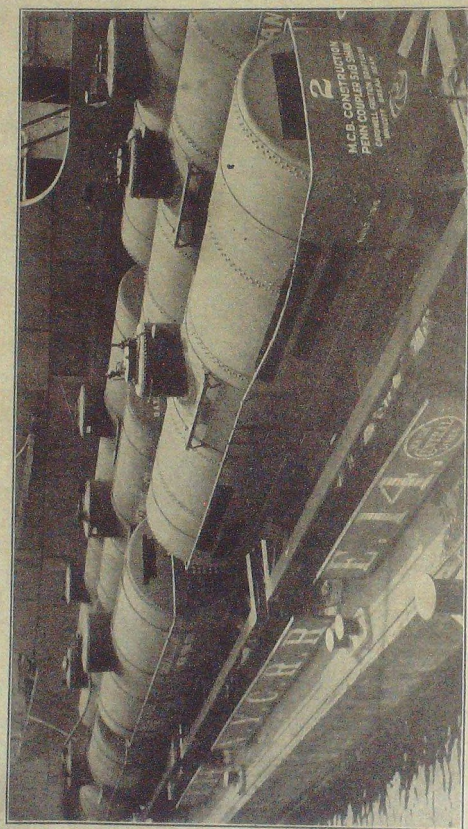
FIG. 46.—Unloading latex in New York from steamer to tank cars

III. FINANCIAL ASPECTS OF INDUSTRY[2]

CAPITAL COSTS

Capital costs include all clearing of the land, planting, maintenance until the trees are tappable, and equipping the estate with staff bungalows, laborers' quarters, hospital, all other buildings, factory, machinery, roads, drains, etc. Some of the main factors affecting these costs are listed below:

Local conditions:
- (a) Location as regards existing estates under same management.
- (b) Labor supply.
- (c) Accessibility of land to existing roads.
- (d) Cost of land.

Nature of land:
- (a) Topography—flat, swampy, undulating, hilly.
- (b) Growth—jungle, secondary growth, or lallang.

Opening methods:
- (a) Clean clearing and stumping as opposed to allowing stumps and timber to remain; resultant losses from disease.
- (b) Soil-conservation methods.
- (c) Planting methods.

Building construction—permanent, semipermanent, or temporary; type of factory.

Quality of management.

Unforeseen accidents during opening.

Health during opening.

Time at which work was carried out.

COST OF OPENING

Opening is generally done on contract, especially in Malaya. The rates charged will depend on locality (whether isolated or not), reputation of management, etc. Even the closest estimates made several months previously may have to be altered materially. The price of rubber, with resultant competition for labor, or the price of tin and other products, drawing away labor from rubber estates, may also influence costs.

The location of the estate will greatly affect costs of equipping with roads, etc., including communication with Government roads; this is not always allowed for in estimates. Sometimes the work of

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[2] For value of foreign currencies, see Table 168, page 301.

opening is hurried; roads are improperly constructed; drains not properly laid out. This usually results in the work being done over again in later years, thus increasing capital costs.

Land may be obtained practically free, or it may cost up to $50 U. S. per acre, depending on location. Flat and undulating land may or may not require draining. Undulating and hilly land requires soil conservation. Heavy jungle is more expensive to clear than secondary growth (blukar) or lallang. Lallang may or may not be more expensive than secondary growth.

OTHER ITEMS OF OPENING EXPENDITURE

When opening, it is not always possible to guard against an outbreak of fever. This may have a severe effect on opening plans, resulting in certain work like weeding getting out of hand, with heavy subsequent expenditure on cleaning up the area or replanting it, and adding very materially to costs. Besides, it involves heavy medical expenses, perhaps relocation of laborers' quarters, new recruiting, etc.

One estate may clean clear the land before planting; another may leave the stumps in the ground and let the timber lie. If root disease appears, the expenditure on treatment may add very materially to the capital cost.

One estate may put in soil and water conservation works at the outset; another may never put them in. Some methods of conserving soil are decidedly more expensive than others.

The risk involved varies with the unfamiliarity of the management with the district where opening is planned.

If weather is unpropitious, one may get a bad burn, with increased costs in subsequent clearing.

Costs of planting will depend on the number of trees planted per acre, and whether all or a part of the trees are budded. With close planting there is the subsequent cost of removal to consider.

One estate will put up temporary or semipermanent buildings (an almost essential practice on unhealthful estates, where the sites have to be proved), to be replaced later on, generally out of revenue. Another will put up permanent buildings, charged directly to capital.

New processes of manufacture may make possible important economies in factory installation.

VARIATION IN ACCOUNTING PRACTICE

Published reports of rubber companies show variability in costs for the following reasons:

Extensions to planted area are frequently made out of profits or share premiums without corresponding adjustments in issued capital account. (This practice was prevalent until the tax situation brought about a widespread reorganization of capital issues several years ago.) The issued capital often bears no relationship to the actual capital expended.

The property account (sometimes called the "development account") includes the purchase price of land, planted or unplanted, which may be above or below its real value.

Most estates write off depreciation, in varying amounts, every year, so that to find the original cost of certain buildings and machinery it is necessary to go back over every annual report and add on the depreciation which has been deducted. A few estates book depreciation to a reserve, showing the full amount written off.

Many estates have been under some previous cultivation, and part of the capital cost of the present rubber area has in reality been borne by the former crops.

Another important factor influencing published costs is the history of the company—whether the land has been developed by the present owners, or whether the property was purchased in a partially developed state from previous owners; this was the case in the majority of instances. Management has frequently changed; estates have been handed over from one agency to another, thus rendering deductions more difficult.

On estates with both mature and immature areas overheads are distributed to capital and revenue by various systems which differ widely and which make comparison difficult. "Maturity" is used to describe rubber which has reached a tappable size; "bearing" means rubber in tapping. All trees do not grow uniformly, and in order to decide when a particular area should be classified as "mature," after which upkeep is charged to revenue and not to capital, it is necessary to fix upon some standard, such as an arbitrary age—five or six years or more—and say that when the rubber reaches that age, regardless of its size, it shall be regarded as "mature." Some estates use as a standard a certain number of tappable trees per acre. "Bearing" does not mean "self-supporting." The time at which rubber becomes self-supporting depends chiefly on the price of rubber.

ACTUAL CAPITAL COSTS

Most of the figures given below (Table 3) have been furnished by various agents and are accurate and complete. Where estates still have immature areas allowance has been made for bringing these to maturity. A few figures have been extracted from published balance sheets and may not be complete. No interest charges appear in these accounts.

The data are valuable only as a general guide. In many instances the properties were purchased in a partially developed state from previous owners, and there is no record of what had been spent before. There have also been different methods of opening, different types of land, etc., as explained previously.

As pointed out on page 86, the fluctuation in exchange during the last few years makes a comparison of different companies' reports very difficult, except in the case of Straits dollar companies, where exchange between the Straits dollar and British sterling remains constant. For example, on a flat rate of 15 rupees to the pound sterling the Ceylon rupee companies would show an average expenditure of only £38, against an average of £81 for the Ceylon sterling companies. If the sterling companies had heavy capital expenditure during these years, exchange alone might account for a large part of this difference. On the other hand, the rupee development expenditure, converted into sterling, undoubtedly shows too low a figure, because whatever foreign products were imported for estate use during 1919 and 1920 were booked at a much lower cost in rupees than would have been the case in normal years. There is no way to reduce the rupee capital expenditure to sterling so as to give the reader a true picture. The conversion of guilders [florins] into sterling at the rate of 12 is only approximate; the same difficulty exists as in the case of rupee currency, though not to so marked a degree.

DISTRIBUTION OF CAPITAL COSTS

As will be seen, the figures are divided into two general headings, "Development," giving data on 66 companies and 157,000 acres, and "Buildings, machinery, etc.," covering 51 companies and 145,000 acres. "Development" includes the purchase price and

costs (exclusive of interest charges, as already said) incurred in opening up and planting the land and maintaining it until the trees are tappable; also construction of roads, drains, etc. "Buildings, machinery, etc.," includes all staff and labor quarters, factory, storehouses, machinery, hospital, transport equipment, furniture and fixtures, and similar outlays.

The third heading, "Total capital costs," is a summary of the data on those companies for which information is practically complete.

TABLE 3.—CAPITAL COSTS

Companies	Approximate planted acreage over which figures were compiled	Range	Average	Remarks
DEVELOPMENT				
12 Malaya sterling	41,000	£41 to £82	£55	Figures include estimate for immature area.
6 Malaya sterling	17,000	£38 to£66	£57	Figures practically complete.
6 Malaya dollar	4,200	£53 to £78 (S.$457–$670.)	£68 (S.$581.)	
15 Sumatra guilder	59,000		Fl. 685 (£57.)	Figures include estimate for immature area.
2 Sumatra guilder	8,000	£39 to £51	£42	Do.
10 Ceylon rupee	9,000	Rs. 390 to Rs. 913	Rs. 570	Figures incomplete.
13 Ceylon sterling	15,000		£81	Do.
1 Burma sterling	2,000		£78	Figures complete.
1 Borneo sterling	2,000		£72	Do.
BUILDINGS, MACHINERY, ETC.				
12 Malaya sterling	41,000	£12 to £23	£17	Figures include estimate for immature area.
6 Malaya sterling	17,000	£9 to £16	£13	Figures practically complete.
15 Sumatra guilder	59,000		Fl. 131 (£11.)	Figures include estimate for immature area.
2 Sumatra guilder	8,000	£11 to £16	£15	Do.
13 Ceylon sterling	15,000		£6	Figures incomplete
1 Ceylon rupee	1,000		Rs. 208	Figures complete
1 Burma sterling	2,000		£10	Do.
1 Borneo sterling	2,000		£16	Do.
TOTAL CAPITAL COSTS				
12 Malaya sterling	41,000	£56 to £94	£72	Figures include estimate for immature area.
7 Malaya sterling	19,000	£52 to £77	£70	Figures practically complete.
15 Sumatra guilder	59,000		Fl. 816 (£68.)	Figures include estimate for immature area.
2 Sumatra guilder	8,000	£55 to £62	£57	Do.
13 Ceylon sterling	15,000		£87	Figures incomplete.
1 Burma sterling	2,000		£88	Figures complete.
1 Borneo sterling	2,000		£88	Do.

CAPITAL COSTS IN JAVA

Costs for Java are not included in the above table because details in a comparable form were not obtainable. However, the following information may be of interest in this connection.

Working with free labor in Java, a large group of estates which planted in 1919, 1920, and 1922 reported the first-year costs of opening and planting a large acreage as: In 1919, £12.05; in 1920, £18.47; in 1922, £15.46. The large increase in 1920 was possibly due chiefly to the high wages demanded by labor as a result of the high prices

obtained for locally grown products. Some of the properties were interplanted with coffee, which no doubt increased the cost somewhat.

The same group reports a cost of about £46 for large areas of rubber in full bearing, which were planted in 1913 and previously. For subsequent plantings, however, the cost to the end of 1922 was over £48, and a rough calculation made of the additional expenditure required to complete these areas indicated that the final all-in cost would be about £60. This includes all buildings, equipment, factory, general management expenses, etc., but does not take into consideration any further expenditure on coffee or any return from that crop.

As a check against these results, reference is made to a letter from a well-known rubber authority which was widely published in journals interested in rubber, in which it was stated that the average issued capital of 288 Malayan companies was £58 and of 42 Sumatra companies £60. The debentures and reserves about balanced the "water" in the capital. From the experience of his own firm the writer of the letter concluded that £60 was an understatement rather than an overstatement; and he pointed out that in Borneo, where land is plentiful, estates show a capital cost well in excess of £60.

ESTIMATES BY LEADING AUTHORITIES

The following table shows the estimates of cost of opening jungle land given by the different men interviewed. There was doubtless some variation in the conditions which each had in mind when giving this estimate, though an attempt was made to have them as uniform as possible; it is not certain that all the estimates included cost of land, for example. The figures are of value chiefly as a cross section of general opinion.

TABLE 4.—ESTIMATE OF CAPITAL COST

Countries	Number of estimates	Range	Average
Malaya	26	£45–£80	£61
Ceylon	14	42– 70	55
Java	5	35– 59	44
Sumatra	11	42– 80	62
Total	56	35– 80	58

Estimates of cost of extending from a nucleus given by five men ranged from £26 to £40 and averaged £30. In considering any large development program in new areas it is important to reckon on competition from cheap extensions to present areas.

DETAILED ESTIMATES

After examining a number of different sets of estimates, the following are adopted as representative of conditions which would be encountered in large opening programs. The expenditure on buildings, factory, and machinery is put at a low figure; but ideas have altered considerably in recent years as regards both the number of buildings required and the type of factory and machinery necessary to handle a given crop. Expenditure on other items might be kept

below the estimates; nevertheless in view of the possibility of unforeseen circumstances arising it is believed that the estimates are not too generous but that they can be worked to with reasonable good fortune.

These detailed estimates show a higher total than the averages quoted on page 51; but this can be explained by the fact that these figures are based on careful observations on present-day costs, whereas in many cases the planters who gave rough estimates on cost of opening had not opened any large areas for many years and were simply giving their general impressions. The figures represent the capital expenditure which it is believed would be necessary to open and plant an acre of jungle land in Malaya and Sumatra, together with upkeep for six years, should average conditions be encountered.

TABLE 5.—ESTIMATE OF CAPITAL COST,[1] MALAYA AND SUMATRA

Items	Cost per acre	Remarks
1. Preliminary expenses	$3	Depends on accessibility; may be more. Items 3, 4, 5, 6, and 7: May cost $40 to $50 less in Sumatra, and perhaps less in Malaya, if in favorable locality. This work is done by Chinese on contract in Malaya and by indentured Javanese labor in Sumatra. Item 7 also depends on topography.
2. Roads	5	
3. Felling	12	
4. Clearing and burning	40	
5. Stumping and burning	80	
6. Sundry expenses in connection with clearing	4	
7. Soil conservation, draining, and changkolling	30	
8. Lining, holing, and planting, including nurseries	17	
9. Upkeep: First year (6 months), $12; second year, $20; third year, $20; fourth year, $15; fifth year, $15; sixth year, $15; total	97	
10. Miscellaneous purchases, etc.	7	
11. Temporary buildings	5	
12. Permanent buildings (third year)	25	
13. Factory, machinery, etc. (fifth year)	20	
14. General charges: Superintendence, $130; labor charges (recruiting, medical expenses, etc.), $60; other, $25; total	215	Includes head-office charge. Labor charges will be 30 to 40 per cent higher in Sumatra.
Total	560	
15. Cost of land	40	Less in Sumatra. See page 14.
Total heavy jungle: In Straits currency	$600	
In pounds sterling	£70	
If lallang or secondary growth deduct	$85	
Net total: In Straits currency	$515	
In pounds sterling	£60	

[1] Straits currency except as indicated.

Subject to the remarks above, the cost of opening in Sumatra will be approximately the same as in Malaya.[2]

YEARLY APPORTIONMENT OF THIS EXPENDITURE

The above expenditure will be incurred approximately as follows: First year, $290 Straits (£34 sterling); second year, $57 (£7); third year, $80 (£9); fourth year, $51 (£6); fifth year, $71 (£8); sixth year, $51 (£6); total, $600 (£70).

Compound interest at 8 per cent will work out as follows: First year, nil; second year, $23 Straits; third year, $30; fourth year, $38; fifth year, $46; sixth year, $55; total, $192 (£22).

[2] The estimate of capital costs of planting in Sumatra, contained in the volume entitled "Rubber, Tea and Cacao," prepared by the Federation of British Industries, 1924, pages 122 and 123, shows a total of £70 14s. 7d. per acre, excluding interest charges.

Most authorities estimate that eradicating lallang costs from $50 to $60 Straits per acre, and that light jungle costs about the same or possibly a little less. This means a saving of $75 to $85.

ESTIMATE OF CAPITAL COSTS IN COCHIN CHINA

The chief reasons why costs may vary in different countries are labor conditions and the type of land, its location and price. Wages in Cochin China are as high as in Malaya; it is possible that a little more work is done per laborer per day. The lenient Government labor regulations, however, have an important bearing on costs, because a high standard has not been set for housing or sanitation.

As to land, the purchase price is low; bamboo land is very cheap to open; the apparent absence of root disease up to the present makes the removal of stumps unnecessary in jungle land; and on the large stretches of flat or gently undulating land soil conservation and draining are inexpensive. Taking the piaster as equal to the Straits dollar, it is estimated that the following savings (stated in Straits dollars) could be made in opening in Cochin China as against Malaya:

Clearing of land ($136—$28)	$108
Soil conservation and draining, about	10
Upkeep, about	30
Buildings, temporary type only, approved by Government, about	10
Cost of land ($40—$5)	35
Total saving	193
Deduct extra cost of recruiting, reengagement, etc., about	10
Net total saving	183
For bamboo land, there is a further saving of $28—$6	22
Total saving	205

This brings the cost down to £49 (£46 in the case of bamboo land), as opposed to £70 in Malaya. The highest figure given for Cochin China was £40; most planters put the cost much lower still; but it is believed that £50 is not too high, assuming equal standards of work. In gray-soil districts, the cost of opening would be less, because expenditure on buildings would be greatly reduced and sanitation and recruiting would cost practically nothing.

Not much information can be gleaned from the published balance sheets of Cochin China estates because they are kept in francs, in which there has been such great fluctuation. One report examined, which appeared fairly clear, gave a cost per acre to date, on areas not entirely mature, of £53, using the rate of exchange given in the report.

LABOR EFFICIENCY

As wages form so large a part of expenditure in planting and producing rubber, one of the first points to consider, in comparing conditions in different countries, is the relative efficiency of labor, as determined by the actual amount of work done in a given period of time, and the wage paid.

In Sumatra, where opening is done with Javanese indentured labor, the amount of labor required is approximately as follows:

TABLE 6.—DAY TASKS PER ACRE ON OPENING, IN SUMATRA

Operations	Jungle [1]	Blukar [1]	Lallang [1]
	Day tasks [2]	Day tasks [2]	Day tasks [2]
Felling	20	8	8
Clearing	90	25	
Stumping	100	30	
Chankelling	63	40	[3] 40
Total for these four operations	273	103	48
Lining and holing	6	6	6
Nurseries	10	10	10
Planting and watering	10	10	10
Drains [4]	20	20	20
Roads	5	5	5
Total day tasks per acre	324	154	99

[1] The distinction between jungle, blukar, and lallang is not always clearly marked; jungle also varies greatly, so these figures can only be taken as relative.
[2] By "day task" is meant the amount of work which is allotted to a laborer to complete in one day, regardless of the time occupied. It is fixed to enable the individual worker to finish within the usual hours; and may vary slightly in size, depending on the skill or industry of the laborer.
[3] To eradicate lallang completely requires 135 day tasks; the balance is usually charged against weeding.
[4] This covers drainage only. If hilly so that soil conservation is necessary, substitute 50 day tasks per acre; also 5 day tasks for roads and 5 for preliminary work should be added.

Approximately one laborer per acre is required for opening.

LABOR REQUIREMENTS DURING NONPRODUCTIVE PERIOD

During the period when the trees are coming into bearing a certain amount of attention must be given the plantation, the total diminishing as the trees mature. This work is apportioned about as follows:

TABLE 7.—DAY TASKS PER ACRE ON UPKEEP OF NONPRODUCING AREA

Operations	First year	Second year	Third year	Fourth year
	Day tasks	Day tasks	Day tasks	Day tasks
Weeding	75	45	20	15
Drain upkeep	10	10	10	10
Road upkeep	1	1	1	1
Supplying	2	1		
Pruning	3	3		
Pests	1	2	2	2
Total day tasks per acre	92	62	33	28

On the basis of 318 days per annum, this upkeep work requires one laborer to every 3.5 acres of plantation area in the first year, one to every 5.1 acres in the second year, one to every 9.7 acres in the third year, and one to every 11.4 acres of plantation area in the fourth year.

AVERAGE DAY TASKS

In Malaya opening work, as well as much of the work on nonproducing and producing areas, is done by giving out contracts to Chinese, Javanese, or Malays. The amount of work performed per laborer is not known. Even on contract tapping with Chinese a manager does not know what each tapper earns as he is paid by the foreman of the gang.

Following are some figures giving a rough idea of what the average Eastern laborer may be expected to do under average conditions:

Draining, soil conservation, etc.—From 250 to 300 cubic feet per day on stiff white soil and from 400 to 450 cubic feet on red soils, including clean-cut sloping sides, bunds, and sometimes planting of cover crop.

Terraces.—Lengths of 150 to 180 feet, equal to about 300 cubic feet, absolutely level.

Chankolling.—Once only, removing all grass, roots, and wood to depth of 15 to 18 inches: On lallang land, 450 square feet (more if wet); on jungle land, 900 square feet (less if wet); average about 720 square feet.

Weeding.—Wet weather—day task 1.7 to 2.1 acres, afternoon work only 0.4 to 0.6 acre; dry weather—day task 2.5 to 3.3 acres, afternoon work only 0.8 to 1.0 acre.

Thinning.—Five to seven trees per day, with some roots, cut, piled, and burned.

ALLOTMENT OF PLANTATION LABOR

Working on an acreage-per-laborer basis, the amount of labor required for all upkeep is approximately:

On immature areas, 1 laborer for every 7 acres.
On mature areas, 1 laborer for every 15 to 20 acres.

The labor requirements of one group of estates in Sumatra, with both mature and immature rubber, work out as follows, on the basis of 4.7 acres per laborer:

	Per cent		Per cent
Tappers	65. 1	Marking trees	1. 5
Tapping materials	2. 4	General charges	4. 8
Weeding (in addition to tappers)	3. 9	Indirect labor	8. 6
Tree diseases	3. 3	Foremen	4. 1
Thinning	3. 3	Factory	1. 0
General upkeep	1. 0		
Burning dead wood	1. 0	Total labor force	100. 0

INDIRECT COST OF LABOR

In addition to actual wages paid to labor, there are the indirect charges, such as recruiting, repatriation, hospital expenses, sanitation, upkeep, and depreciation of laborers' quarters. Following is a list of seven groups of estates illustrating this:

TABLE 8.—RATIO OF WAGES TO TOTAL COST OF A DAY TASK

Groups	Cost of day task		Ratio of wages to total cost
	Total	Wages	
	Straits cents	*Straits cents*	*Per cent*
A	76. 0	42. 8	56
B	73. 0	45. 2	62
C	[1] 54. 0	36. 9	68
D	85. 0	49. 1	58
E	77. 0	39. 8	52
F	66. 0	39. 4	60
G	[2] 49. 2	32. 8	67

[1] Depreciation charge very low.
[2] Recruiting charge abnormally low; for details see page 217.

Under normal conditions wages would constitute 60 to 65 per cent of the total labor charges and form nearly 40 per cent of the total cost of bringing an acre of rubber into bearing.

INTEREST CHARGES DURING WAITING PERIOD

Rubber trees do not produce during the first four or five years. Consequently, during this period the investor receives no return on his money.

In considering the subject of interest during the waiting period, investors fall into two general classes—(*a*) those who purchase shares in a public company and (*b*) those who plant rubber on borrowed funds. No public company, to the writer's knowledge, has ever charged interest to capital account during the waiting period. It is difficult to see how this could be done, when no interest obligations have been incurred by the company. It is a matter for the individual shareholder to calculate whether his purchase of shares in any company will give him an adequate return on his outlay, including interest during the period he is obliged to wait. Interest has been charged by private owners, such as manufacturers, and is apparently justifiable, as it represents the actual cost of the estate to the manufacturer.

Purchasers of shares fall into two subdivisions—(*a*) speculators looking for capital appreciation and (*b*) investors looking for a return in dividends. If the speculator buys shares in a new, nonproducing plantation, he gets a natural appreciation in value as the estate approaches maturity; for an estate on which, say, £45 has been spent over a period of four years is obviously worth more than the bare £45 cash expended. In such instances, were the present owners contemplating a sale, compound interest would no doubt be a measure, at least, of the enhanced value of the estate.

Purchasers of shares who intend holding them for subsequent dividends will do so with the view of obtaining a better average return, over the period of their investment, than they could obtain at home. But as the plantation produces no crop during the first four or five years, there is no return during that period to include in any average. They would seem justified, therefore, in basing their return on the cash expended on the property, plus interest during the waiting period. So far, this agrees with the opinions recently publicly expressed by leading members of the planting industry; but the rate of interest taken—usually 15 per cent—seems too high to the writer.

INTEREST RATE

This rate is based on the greater risk involved in investment in tropical agriculture; but the risk lies in the investor's not receiving his anticipated return, due to low prices, disease, and other hazards. It is true that the investor also incurs a risk during the waiting period, but it is a risk involving capital and not earnings; and actually he is obliged to ignore it, for no rate of interest, however high, would compensate him for such a loss, since he has no means of reimbursement. He takes this risk without recourse, hoping for an ultimate return that will compensate him. Or, looking at it from another angle, a plantation owner who has suffered some loss during the waiting period obviously can not sell his estate at an enhanced value because of the risk he took and the loss he sustained.

It would seem, therefore, that the proper interest charge would be more closely related to the return which the investor is deprived of at home by placing his money elsewhere; this would be perhaps 6 or 7 per cent. Again, the investor is the final arbiter as regards both the return and the risk. Every flotation is drawn with the aim of appealing to him, and his demands dictate the terms of the flotation. The question then arises as to whether investors would buy securities in a plantation company on the basis of 6, 7, or 8 per cent return during the

waiting period and an expectation return of 15 per cent thereafter. London flotations indicate that ample funds would normally be available on this basis.

The writer would be inclined to take 8 per cent as a reasonable rate of interest to charge during the waiting period in order to arrive at the total outlay of the investor for purposes of calculating the return to which he is entitled.

If a plantation owner were to protect his investment by insurance against risk (assuming that insurance companies would write this type of business), the risk immediately disappears and the value of the investment is enhanced accordingly; but in this event there would be still less reason for charging a high rate of interest against capital, because of the protection afforded.

CAPITAL AND PRODUCTION COSTS IN COTTON GROWING

Doubt has been expressed by some as to whether a high capital expenditure is justified. The situation in the cotton-growing industry—while not parallel—is of interest in this connection.

The following information and diagram are reproduced from "The Cotton Situation," by A. M. Agelasto, C. B. Doyle, G. S. Meloy, and O. C. Stine, United States Department of Agriculture, 1921:

AREA	NET COST PER ACRE DOLLARS	NET COST PER POUND CENTS	YIELD OF LINT PER ACRE
ANDERSON CO. S.C.			286
MARSHALL CO. ALA.			272
BARNWELL CO. S.C.			248
GREENE CO. GA.			225
LEE CO. ARK.			173
LAUDERDALE CO. ALA.			192
MITCHELL CO. GA.			159
MONROE CO. MISS.			132
LAURENS CO. GA.			91
ELLIS CO. TEX.			80
RUSK CO. TEX.			60
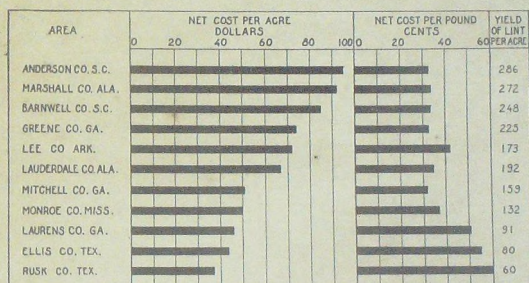
FIG. 47.—Variations both in the cost per acre and in the yield per acre cause variations in the net cost per pound of lint. The average acre in Anderson County cultivated at the highest cost in 1919 produced the highest average yield at the lowest cost per pound

It costs more to produce cotton in some regions than in others. The net cost per acre and the net cost per pound of lint in 1919 are shown in Figure 47 for each of 11 typical Cotton Belt counties. The average yields per acre reported in each case are shown in a column to the right of the chart. It will be noted that high cost per acre with good yields may result in low cost per pound, and low cost per acre with ordinary or poor yields in high cost per pound. In fact, judicious expenditures for fertilizer, good seed, good care of the crop, or a combination of them, pays. In any year much depends upon the seasonal weather. The 1919 crop was practically a failure in three of the counties surveyed.

PRODUCTION COSTS

Before comparing costs, a reliable and uniform basis is necessary. There is serious doubt as to whether "cost of production per pound of rubber" is a proper measure of comparison—if not, indeed, mis-

leading; "cost of operation per acre" would seem a better guide. This is illustrated by Figure 48 based on 13 Malayan companies under the same control for the year 1922.

In order to find whether costs per pound or costs per acre were more constant in their grouping around any given level, the two curves were plotted on the same relative scale, arranging costs in ascending order. As is apparent, the "cost per acre" curve shows more regularity, without regard to the relative position of the various companies. Thus the costs per acre of 9 out of the 13 companies ranged between $60 and $75 Straits, whereas the same range on the scale in costs per pound would take in only 5 companies.
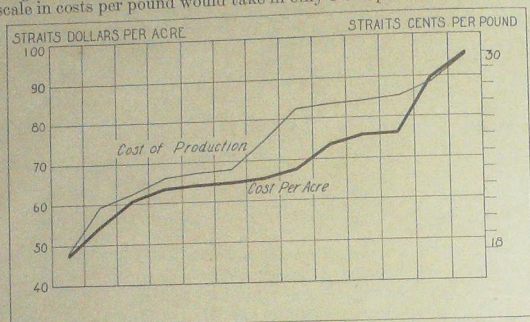
FIG. 48.—Range in costs per acre and costs of production per pound

OPERATING COSTS PER ACRE

"Cost per acre" is a more reliable gauge than "cost per pound," due chiefly to yield. Two estates may have the same topography but entirely different soil. One estate may yield more than the other, with a lower cost of production per pound of rubber, though actually the poorer estate may be working more economically.

In Figure 49 the "cost per acre" curve is repeated, with costs of production added for each company. This shows practically no relationship between cost per acre and cost of production (cents per pound), except for the last five companies.

To see if any relationship exists between "cost of production" and "yield per acre" the third curve was plotted with its base line at the top of the diagram instead of at the bottom. Thus, the curve rises on a low yield and falls on a high yield. Here the relationship is exceedingly marked, especially with the first eight companies, where it is apparent that high yields mean low costs of production.

The last five companies show a high cost per acre, a high yield, and a high cost of production. This suggests that, other things being equal, they may be extravagantly run. Perhaps the true explanation lies in some special condition, such as increased expenditure sanctioned to improve the estates; or perhaps the estates showing a low expenditure were obliged to economize during the depression because of their financial position.

PRODUCTION COSTS PER POUND

"Cost per acre" figures are of little significance under certain headings; "cents per pound" is the significant figure for:

Tapping and collection.
Manufacturing, packing, and f. o. b. shipping charges.
Local export taxes.
Commission to staff.
Freight and insurance to London.
Corporation and income taxes.

The above charges vary more directly with actual production. In the case of the 13 companies used in the example, a large part of the mature area was rested. It would require upkeeping, general charges, etc., but no tapping and collection charges, for instance, would be incurred on the rested area.
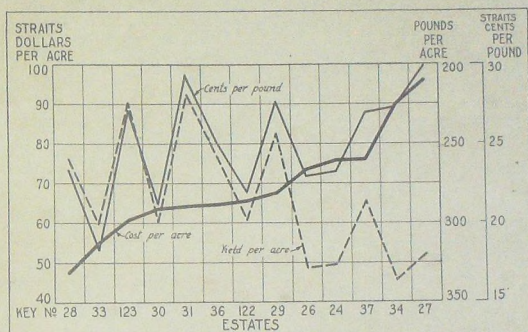
Fig. 49.—Comparison of "cost of production in Straits dollars per acre," "cost of production in Straits cents per pound," and "yield per acre"

CHOICE OF COMPANIES

As there are thousands of public companies engaged in the cultivation of rubber, it became necessary in the course of the present investigation to make some kind of arbitrary but fair selection if the field work was to be completed in a reasonable time.

With the exception of Java, companies with mixed cultivation were excluded because of the difficulty of allotting expenditure to the various crops.

Of the remaining companies, a number were chosen indiscriminately. Some have large acreages, some small. Most of them are relatively old and have therefore a better history on which to work.

It is felt that the companies are representative of the industry as a whole, and that multiplying their number would not have materially aided in making deductions regarding costs.

ESTATE EXPENDITURE

As few companies compile their costs on a uniform basis, it was necessary to take each individual set of accounts and readjust the expenditure as well as possible to a uniform set of headings in order to get a fair comparison.

"Estate expenditure" has been taken as all expenditure on—

Upkeep of producing area.
Tapping and collection.
Manufacturing (preparation of latex).
Packing and shipping charges to local ports.
General charges incurred on estate—superintendence, maintenance of buildings, hospitals, etc.
Local taxes.

With the exception of local taxes, this gives an idea of the expenditure incurred on an estate in producing the rubber; but it is not an f. o. b. cost. So many different practices exist in arriving at an f. o. b. cost that no attempt will be made to reduce published costs to this basis. Usually, however, depreciation of buildings and machinery would be added to the above.

MISCELLANEOUS CHARGES

In addition, there are many other charges which must be brought in before the total expenditure in producing a pound of rubber can be arrived at. Among these are:

Depreciation on buildings, machinery, furniture, etc.
Depreciation on rubber area and concessions. (Only a few estates include this item.)
Corporation and income taxes.
Head-office expenses.
Directors' fees.
Commission and bonus to staff.
Freight and insurance to consuming markets.
Marketing charges.

Some of these items are treated as "allocation of profits" and are not taken into the cost of production. During the past few years there have also been extraordinary expenditures under such headings as loss in exchange, when currencies fluctuated violently after the war, and loss on rice and other foodstuffs, when there was a general food shortage in 1919 and 1920.

General reserves set up were not included in the expenditure; only special reserves for taxation or for passage money, covering home leave of employees, etc., were taken in.

It is well to note here that the difficulties pointed out on page 48 in interpreting costs of opening of various companies apply equally to costs of production.

ANALYSIS OF CEYLON RUPEE COMPANIES

The following table gives the results of 10 rupee companies in Ceylon:

TABLE 9.—ANALYSIS OF 10 CEYLON RUPEE COMPANIES

Items	1919	1920	1921	1922
EXPENDITURE PER ACRE	Rupees per acre	Rupees per acre	Rupees per acre	Rupees per acre
Estate expenditure	170.00	188.00	107.00	117.00
Colombo administration charges	6.05	6.33	5.86	5.87
EXPENDITURE PER POUND OF RUBBER	Rupee cents per pound	Rupee cents per pound	Rupee cents per pound	Rupee cents per pound
Estate expenditure	45.6	48.3	30.0	28.8
Net revenue expenditure [1]	54.7	54.3	36.1	34.4
Depreciation	2.5	1.8	2.2	1.7
YIELD OF RUBBER	Pounds	Pounds	Pounds	Pounds
Yield of rubber per acre in bearing	374	388	357	408

[1] Net revenue expenditure, after including depreciation, bonuses and commission to staff, loss on exchange, head-office expenses, etc., but deducting miscellaneous receipts. In 1919, 7 estates gave bonuses to managers; 6 in 1920, 3 in 1921, and 4 in 1922.

As will be apparent from the above table, the chief economies effected during the last four years were in estate expenditure. Depreciation, though dropped in some instances, was not neglected to the extent one might have anticipated. Colombo administration charges decreased very little. Fewer managers received a bonus, and this was much smaller. The yield per acre showed a decrease in 1921, but a large increase in 1922, indicating that these companies were doing little restricting.

The individual reports show that at least half of the estates were spending large sums on cultivation and fertilizing in 1919—from 7 to 19 rupee cents per pound of rubber produced. In 1920 only two of these estates mention fertilizing; one spent 14 rupee cents per pound, the other 2.75 rupee cents. No mention of fertilizing is made in 1921 and 1922, which corresponds to the information received that it was generally dropped during the depression.

It is important to remember that the above costs do not include freight and insurance to consuming markets, export duty (the crops apparently being sold in Colombo), and other miscellaneous charges which go to make up the cost to the consumer.

LOSS ON RICE, EXCHANGE, AND DEBTS OF LABORERS

Other important factors bearing on the steady reduction of costs during this period are loss on rice and loss on exchange. In 1919 four companies make specific reference to loss on rice, the amounts ranging from 1.43 to 2.84 rupee cents per pound of rubber; in 1920 six companies lost from 3.52 to 7.84 rupee cents per pound; no mention is made of losses thereafter. Eight companies in 1919 give their losses on exchange as ranging from 0.43 to 3.97 rupee cents per pound of rubber; no important loss seems to have been incurred by these companies in subsequent years.

A further source of considerable loss to Ceylon companies during the past two or three years has been the writing off of debts against laborers. Formerly these were carried as an asset on the balance sheet, being recoverable in theory; but when the new labor regula-

tions were introduced, abolishing the "tundu" (certificate showing the laborer's indebtedness, which always accompanied him), it was necessary to write off these advances or debts. Debts averaging as high as 29 rupees per laborer are mentioned by the rupee companies, three of which show writings-off varying from 0.33 to 8.04 rupee cents per pound of rubber.

ANALYSIS OF CEYLON STERLING COMPANIES

Following is an analysis of 13 estates in Ceylon owned by British capital; the accounts are kept in sterling, as the estates are registered in England:

TABLE 10.—ANALYSIS OF 13 CEYLON STERLING ESTATES

Items	1919	1920	1921	1922
EXPENDITURE PER ACRE	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
Estate expenditure	£19.10	£22.30	£10.00	£9.40
London administration charges	.48	.64	.58	.60
EXPENDITURE PER POUND OF RUBBER	Pence per pound	Pence per pound	Pence per pound	Pence per pound
Estate expenditure	11.70	13.70	7.40	6.90
Net revenue expenditure [1]	13.30	15.50	8.20	6.80
Depreciation	.36	.32	.40	.32
Freight, insurance, commission, brokerage, wharf and sale charges, etc., on London and Liverpool shipments	1.04	1.40	.58	.52
YIELD OF RUBBER	Pounds	Pounds	Pounds	Pounds
Yield of rubber per acre in bearing	393	392	327	377

[1] Net revenue expenditure after including depreciation, bonuses and commission to staff, loss on exchange, head-office expenses, freight, and insurance on London and Liverpool shipments, but deducting miscellaneous receipts.

Shipping charges to London showed a marked reduction, due to falling freights.

ANALYSIS OF MALAYA DOLLAR COMPANIES

Following is an analysis of Malaya dollar companies registered either in the Straits Settlements or in the Malay States and owned locally for the most part. In Table 11 are given the area, total crop, and average yield per acre of mature rubber of the estates whose financial reports are digested in Table 12:

TABLE 11.—AREA AND YIELD OF MALAYA DOLLAR COMPANIES

Fiscal years	Companies	Area	Crop	Yield per mature acre
	Number	Acres	Pounds	Pounds
1919	19	15,307	5,587,410	365
1920	19	15,421	5,792,144	376
1921	18	15,190	3,955,015	260
1922	19	15,895	5,545,611	349

TABLE 12.—ANALYSIS OF MALAYA DOLLAR COMPANIES [1]

Items	Companies	1919	1920	1921 [2]	1922
EXPENDITURE PER ACRE	*Number*	*Straits dollars per acre*	*Straits dollars per acre*	*Straits dollars per acre*	*Straits dollars per acre*
Total estate expenditure	19	122.83	141.22	78.06	73.14
Range		89.13–185.50	112.55–218.20	49.75–117.31	46.81–102.73
Depreciation on buildings, machinery, etc.	16	7.60	7.88	7.29	6.66
Freight and insurance	8	6.49	6.77	3.87	4.52
Administration charges	13	5.53	5.43	4.72	4.73
Total revenue expenditure	16	153.50	179.16	96.36	91.04
Range		118.85–189.27	143.05–240.95	67.08–141.59	68.33–135.96
EXPENDITURE PER POUND OF RUBBER		*Straits cents per pound*	*Straits cents per pound*	*Straits cents per pound*	*Straits cents per pound*
Total estate expenditure	19	33.65	37.60	29.98	20.96
Range		24.32– 46.55	31.57– 58.07	19.39– 83.81	15.41– 31.45
Depreciation on buildings, machinery, etc.	16	2.06	2.05	2.24	2.17
Freight and insurance	8	1.85	1.87	1.37	1.23
Administration charges	13	1.50	1.49	1.63	1.34
Total revenue expenditure	16	41.80	47.68	36.12	25.56
Range		34.74– 56.89	37.73– 70.23	25.23– 56.88	20.85– 34.70

[1] Data relate to fiscal years.
[2] Figures for 1921 are for one company less.

ANALYSIS OF 12 MALAYA STERLING COMPANIES

Following is an analysis of 12 sterling companies in Malaya under the same control; the accounts are kept in Straits currency:

TABLE 13.—AREA AND YIELD OF 12 MALAYA STERLING COMPANIES

Fiscal years	Companies	Area	Crop	Yield per mature acre
	Number	*Acres*	*Pounds*	*Pounds*
1919	12	28,971	9,844,388	340
1920	12	29,569	11,095,424	375
1921	12	30,333	9,205,615	303
1922	12	30,713	8,725,046	284

Table 14.—Analysis of 12 Malaya Sterling Companies [1]

Items	Com-panies Number	1919	1920	1921	1922
EXPENDITURE PER ACRE		Straits dollars per acre	Straits dollars per acre	Straits dollars per acre	Straits dollars per acre
Upkeep of producing area	12	25.86	29.61	17.18	10.36
Range		12.41- 40.37	10.69- 38.62	10.92- 34.53	2.74- 28.86
Tapping and collection	11	45.15	52.18	31.22	18.13
Range		15.04- 63.16	18.28- 81.97	18.89- 48.24	11.80- 24.01
Manufacturing, packing, and f. o. b. shipping charges	11	17.32	23.81	17.40	12.20
General charges	12	36.85	49.27	40.57	27.07
Range		27.83- 43.73	35.52- 56.83	30.83- 67.27	22.92- 38.36
Export taxes, levied locally	11	4.75	7.66	1.02	.84
Total estate expenditure		133.20	161.06	104.47	69.19
Range		75.79-151.72	86.82-206.98	80.94-150.94	47.50- 95.91
Depreciation on buildings, machinery, etc.	12	11.07	11.97	11.99	10.34
Commission to staff	² 12	2.78	2.94	1.09	.87
Freight and insurance to London	12	25.55	25.93	13.48	9.90
London administration charges	12	6.18	8.07	8.05	7.13
Corporation and income taxes	12	35.90	35.50	29.81	22.95
Total revenue expenditure	12	214.68	245.47	168.89	120.38
EXPENDITURE PER POUND OF RUBBER		Straits cents per pound	Straits cents per pound	Straits cents per pound	Straits cents per pound
Upkeep of producing area	12	7.61	7.89	5.66	3.65
Range		4.69- 10.75	3.60- 10.67	3.15- 10.57	.91- 9.02
Tapping and collection	11	13.71	13.82	10.07	6.49
Range		5.57- 19.76	5.12- 17.82	6.00- 16.93	3.93- 8.28
Manufacturing, packing, and f. o. b. shipping charges	11	5.26	6.31	5.61	4.37
Range		3.88- 8.33	4.60- 7.43	3.90- 6.81	3.63- 4.92
General charges	12	10.84	13.13	13.37	9.53
Range		7.31- 16.85	9.32- 15.41	9.61- 20.73	7.95- 12.29
Export taxes, levied locally	11	1.75	2.03	.33	.31
Range		.84- 2.27	1.53- 2.39	0 - 1.06	.11- .73
Total estate expenditure	12	39.20	42.92	34.42	24.35
Range		33.81- 48.78	31.02- 50.14	26.31- 30.27	18.25- 29.98
Depreciation on buildings, machinery, etc.	12	3.26	3.19	3.95	3.64
Commission to staff	² 12	.82	.79	.37	.32
Freight and insurance to London	12	7.52	6.91	4.44	3.48
London administration charges	12	1.82	2.15	2.65	2.51
Range		1.26- 5.60	1.57- 4.34	1.52- 5.80	1.30- 4.06
Corporation and income taxes	12	10.56	9.46	9.82	8.08
Total revenue expenditure	12	63.18	65.42	55.65	42.38

[1] Data relate to fiscal years.
² The calculations are based on the total acreage and output of the 12 companies, but commission to staff was paid by only 10 companies in 1919, 10 in 1920, 9 in 1921, and 7 in 1922.

Among the interesting points brought out in the above table is the fact that corporation taxes in England have cost these 12 companies from 8.08 to 10.56 Straits cents per pound of rubber produced.

While this analysis supports the previous deduction that the main reduction in expenses has come in estate administration, London expenses show a slight drop and freight charges an important one.

The significance of the analysis, however, lies in the fact that with a yield per acre 24 per cent lower than in 1920 the all-in cost in 1922 was reduced by 39 per cent.

ANALYSIS OF 27 MALAYA STERLING COMPANIES

In the following tables the results of the 12 sterling companies analyzed on pages 63 and 64 were combined with 15 more, under different management.

To give an idea of the amount of data utilized, the acreage and crop are shown for the 20 companies on which revenue expenditure was computed and for the 27 companies on which estate expenditure was computed.

TABLE 15.—AREA AND YIELD OF 27 MALAYA STERLING COMPANIES

Fiscal years	Companies	Area	Crop	Yield per mature acre
FOR TOTAL REVENUE EXPENDITURE	*Number*	*Acres*	*Pounds*	*Pounds*
1919	20	40, 021	13, 129, 514	328
1920	20	41, 589	15, 226, 793	366
1921	20	42, 884	12, 585, 131	293
1922	20	43, 586	11, 860, 896	272
FOR TOTAL ESTATE EXPENDITURE				
1919	27	62, 231	20, 040, 460	322
1920	27	64, 078	22, 500, 880	351
1921	27	65, 683	18, 272, 826	278
1922	27	66, 562	17, 602, 805	264

TABLE 16.—ANALYSIS OF 27 MALAYA STERLING COMPANIES [1]

Items	Companies	1919	1920	1921	1922
EXPENDITURE PER ACRE	*Number*	*Straits dollars per acre*	*Straits dollars per acre*	*Straits dollars per acre*	*Straits dollars per acre*
Upkeep of producing area	[3] 19	21. 20	23. 42	13. 17	8. 59
Range		4. 02–40. 37	5. 47–38. 62	3. 13–34. 53	2. 74–28. 86
Tapping and collection	18	39. 20	43. 07	25. 35	15. 33
Range		15. 04–63. 16	18. 28–81. 97	12. 41–48. 24	8. 94–24. 01
Manufacturing, packing, and f. o. b. shipping charges	18	19. 66	24. 72	17. 81	12. 75
General charges	19	37. 07	51. 68	41. 04	27. 43
Range		27. 33–73. 97	35. 52–77. 58	30. 83–70. 11	22. 92–41. 25
Export taxes, levied locally	16	5. 79	7. 51	1. 09	. 81
Total estate expenditure	27	121. 99	142. 90	97. 85	63. 25
Range		75. 79–200. 39	86. 82–206. 98	43. 35–152. 67	40. 97–95. 91
Depreciation on buildings, machinery, etc	[3] 21	9. 42	9. 39	9. 60	8. 33
Commission to staff	[4] 14	2. 73	3. 01	1. 20	. 87
Freight and insurance to London	15	23. 57	24. 17	13. 06	9. 32
London administration charges	23	5. 84	7. 35	7. 41	6. 30
Corporation and income taxes	18	31. 04	29. 55	23. 32	20. 48
Total revenue expenditure	20	196. 53	220. 91	152. 60	108. 79
EXPENDITURE PER POUND OF RUBBER		*Straits cents per pound*	*Straits cents per pound*	*Straits cents per pound*	*Straits cents per pound*
Upkeep of producing area	[3] 19	6. 13	6. 26	4. 74	3. 19
Range		1. 09–10. 75	1. 65–10. 67	1. 14–10. 57	. 91– 9. 02
Tapping and collection	18	11. 50	11. 48	8. 41	5. 42
Range		5. 57–19. 76	5. 12–17. 82	4. 11–16. 93	2. 96– 8. 28
Manufacturing, packing, and f. o. b. shipping charges	18	5. 77	6. 59	5. 91	4. 51
Range		3. 88– 8. 64	4. 60– 9. 66	3. 90– 9. 50	3. 63– 5. 59
General charges	19	10. 71	13. 81	13. 73	9. 61
Range		7. 31–19. 40	9. 32–17. 36	9. 61–22. 33	7. 95–15. 11
Export taxes, levied locally	16	1. 79	2. 00	. 35	. 30
Range		. 84– 2. 27	1. 09– 2. 43	0 – 1. 15	. 04– . 73
Total estate expenditure	27	37. 88	40. 70	35. 17	23. 92
Range		23. 16–52. 11	26. 82–61. 86	22. 33–77. 65	17. 84–37. 69
Depreciation on buildings, machinery, etc	[3] 21	3. 00	2. 65	3. 42	3. 21
Commission to staff	[4] 14	. 80	. 81	. 39	. 32
Freight and insurance to London	15	7. 15	6. 63	4. 41	3. 41
London administration charges	23	1. 87	2. 12	2. 60	2. 45
Range		1. 08– 5. 60	1. 11– 4. 79	1. 52– 9. 56	1. 30– 6. 14
Corporation and income taxes	18	9. 53	8. 06	7. 91	7. 49
Total revenue expenditure	20	59. 90	60. 34	52. 00	39. 98

[1] Data relate to fiscal years.
[3] Twenty companies for 1921 and 1922.
[3] Twenty companies for 1919.
[4] Twelve companies for 1922.

ANALYSIS OF SUMATRA COMPANIES

Below is an analysis of companies owning estates in Sumatra. In view of the fact that Group B figures are given in sterling in the reports from which Table 18 was compiled the following average exchange rates were used to convert those figures into Dutch guilders: 1919—10.74 guilders (florins) to the pound sterling; 1920—10.86 guilders; 1921—11.49 guilders; 1922—11.50 guilders. Group B acreage figures on which costs have been computed are for the area in tapping and not for the mature area.

TABLE 17.—AREA AND YIELD OF GROUP A–B COMPANIES IN SUMATRA

Fiscal years	Area	Crop	Yield per acre
	Acres	*Pounds*	*Pounds*
1919	43,859	12,474,972	284
1920	44,799	13,581,115	303
1921	44,843	12,748,722	284
1922	43,588	14,383,218	330

TABLE 18.—ANALYSIS OF GROUP A–B COMPANIES IN SUMATRA [1]

Items	Company group	1919	1920	1921	1922
EXPENDITURE PER ACRE		*Guilders per acre*	*Guilders per acre*	*Guilders per acre*	*Guilders per acre*
Upkeep of producing area	A–B	19.04	19.72	26.20	28.33
Tapping and collection	A–B	35.25	42.54	44.81	45.09
Manufacturing, packing, and f. o. b. shipping charges	A–B	8.22	6.42	10.93	8.92
General charges	A–B	76.50	123.84	81.56	31.33
Total estate expenditure	A–B	139.01	192.52	163.50	113.67
Depreciation on buildings, machinery, etc	A–B	6.65	8.89	10.10	9.19
Administration charges	A–B	13.35	8.88	7.41	5.98
Corporation taxes, excess-profits duty, etc	A–B	7.18	11.81	.99	
Loss on exchange	B	16.07	34.60	16.13	3.42
Taxes, etc., levied locally	B	16.74	6.70	.51	
Freight and insurance	A	23.32	15.68	8.06	5.97
Depreciation on rubber area and concession	A		26.64	25.42	32.38
Staff profit-sharing	A	16.36	1.32		1.77
Total revenue expenditure	A	208.08	264.70	207.31	167.21
EXPENDITURE PER POUND OF RUBBER		*Guilder cents per pound*	*Guilder cents per pound*	*Guilder cents per pound*	*Guilder cents per pound*
Upkeep of producing area	A–B	6.69	6.51	9.22	8.59
Tapping and collection	A–B	12.39	14.03	15.76	13.66
Manufacturing, packing, and f. o. b. shipping charges	A–B	2.89	2.12	3.84	2.70
General charges	A–B	26.89	40.85	28.69	9.50
Total estate expenditure	A–B	48.87	63.51	57.51	34.45
Depreciation on buildings, machinery, etc	A–B	2.34	2.93	3.55	2.78
Administration charges	A–B	4.69	2.93	2.60	1.81
Corporation taxes, excess-profits duty, etc	A–B	2.52	3.89	3.47	
Loss on exchange	B	6.27	10.54	4.45	.91
Taxes, etc., levied locally	B	6.53	2.04	.14	
Freight and insurance	A	8.10	5.22	2.92	1.83
Depreciation on rubber area and concession	A		8.66	9.20	9.97
Staff profit-sharing	A	5.68	.44		.54
Total revenue expenditure	A	72.31	88.22	75.04	51.18

[1] Data relate to fiscal years.

ANALYSIS OF JAVA COMPANIES

Following is an analysis of companies owning estates in Java:

TABLE 19.—AREA AND YIELD OF GROUP C–D COMPANIES IN JAVA

Fiscal years	Area	Crop	Yield per acre in tapping
	Acres	Pounds	Pounds
1919	17,696	3,916,367	221
1920	24,014	5,643,180	235
1921	25,997	5,789,020	223
1922	28,183	7,712,961	274

TABLE 20.—ANALYSIS OF GROUP C–D COMPANIES IN JAVA [1]

Items	Company group	1919	1920	1921	1922
EXPENDITURE PER ACRE		Guilders per acre	Guilders per acre	Guilders per acre	Guilders per acre
Upkeep of producing area	C–D	22.77	27.13	13.54	10.20
Tapping and collection	C–D	35.77	39.82	26.30	19.57
Manufacturing and packing	C–D	16.69	18.33	16.84	16.67
F. o. b. shipping charges	C–D	3.67	3.44	2.64	3.76
General charges	C–D	26.44	33.34	28.05	23.77
Total estate expenditure	C–D	105.34	122.06	87.37	73.97
Taxes levied locally	C	7.24	37.77	21.98	9.09
Depreciation on buildings, machinery, etc	C–D	10.22	8.16	9.28	10.31
Depreciation on rubber area and concession	D	9.67	11.43	11.77	12.41
Bonus to staff	C	13.76		9.13	10.09
Directors' fees and head-office charges	D	7.42	7.71	7.96	6.55
Total revenue expenditure	D	167.34	178.51	144.50	136.60
EXPENDITURE PER POUND OF RUBBER		Guilder cents per pound	Guilder cents per pound	Guilder cents per pound	Guilder cents per pound
Upkeep of producing area	C–D	10.29	11.55	6.08	3.73
Tapping and collection	C–D	16.16	16.94	11.81	7.15
Manufacturing and packing	C–D	7.54	7.80	7.56	6.09
F. o. b. shipping charges	C–D	1.66	1.45	1.18	1.38
General charges	C–D	11.95	14.19	12.60	8.69
Total estate expenditure	C–D	47.60	51.93	39.23	27.04
Taxes levied locally	C	3.00	13.40	9.00	3.00
Depreciation on buildings, machinery, etc	C–D	4.62	3.47	4.17	3.77
Depreciation on rubber area and concession	D	4.79	5.54	5.61	4.84
Bonus to staff	C	5.70	3.24	2.48	3.53
Directors' fees and head-office charges	D	3.68	3.73	3.80	2.56
Total revenue expenditure	D	82.92	86.44	69.33	53.33

[1] Data relate to fiscal years

ANALYSIS OF SOUTH INDIA COMPANIES

Not much information was obtained on South India estates. Two showed the following results for 1919 and 1920; the figures for 1921 and 1922 cover one estate only, as the other stopped tapping:

TABLE 21.—ANALYSIS OF SOUTH INDIA COMPANIES

Items	1919	1920	1921	1922
	Rupees	*Rupees*	*Rupees*	*Rupees*
Estate expenditure per acre	155	134	82	93
	Rupee cents	*Rupee cents*	*Rupee cents*	*Rupee cents*
Estate expenditure per pound of rubber	60.5	69.2	30.8	31.2
Net revenue expenditure per pound of rubber	62.6	72.0	31.6	37.7
	Pounds	*Pounds*	*Pounds*	*Pounds*
Yield of rubber per acre	256	194	267	298

ANALYSIS OF COCHIN CHINA COMPANIES

Following are the figures for two large red-soil estates in Cochin China for the year 1922:

TABLE 22.—ANALYSIS OF COCHIN CHINA ESTATES

Items	Estate A		Estate B	
	Per acre	Per pound of rubber	Per acre	Per pound of rubber
	Piasters	*Piaster cents*	*Piasters*	*Piaster cents*
Upkeep of producing area	2.55	0.72	9.82	1.76
Tapping and collection	24.16	6.84	30.82	5.53
Manufacturing and packing	[1] 14.68	4.16	13.44	2.41
General estate charges	33.51	9.49	40.02	7.18
Total	74.90	21.21	94.10	16.88

[1] Including freight to Marseille.

The all-in cost of Estate B comes to about 27 piaster cents per pound of rubber. The combined area of the above estates is approximately 7,500 acres; the average yield per acre in tapping in 1922 was 352 pounds on Estate A and 557 pounds on Estate B. Estate B reported the following costs during previous years:

TABLE 23.—COST OF PRODUCTION ON ESTATE B

Items	1918	1919	1920	1921
	Piaster cents per pound	*Piaster cents per pound*	*Piaster cents per pound*	*Piaster cents per pound*
Estate cost	36.3	27.6	20.1	18.6
F. o. b. cost	49.1	35.6	24.8	22.1
All-in cost	52.0	37.9	28.4	25.0
	Pounds	*Pounds*	*Pounds*	*Pounds*
Yield per acre in tapping		457	557	511

PRODUCTION COSTS ON OTHER COCHIN CHINA ESTATES

Another red-soil estate reports the cost of harvesting the 1922–23 (financial year) crop at 16 piaster cents per pound of rubber, converting from francs into piasters at the rate given in the report, with a crop of 257 pounds per acre. The exchange rate might not be quite accurate; the cost in piaster cents before conversion is not given.

A fourth red-soil estate, medium size, reports an f. o. b. cost of 20.4 piaster cents per pound. A fifth, small, reports 31 piaster cents.

A large gray-soil estate produced in 1923 for 9.1 piaster cents per pound, landed Saigon, but excluding Saigon office charges, depreciation, etc. This estate is unusually well situated as regards both labor and transport; all of its labor comes from local villages, none is housed on the estate. Health is excellent; there are no hospital or medical expenses or similar charges. The land is flat, without requiring drainage; tasks are large.

At the moment Cochin China estates have a distinct advantage over Malaya, for example, because of the restricted crops in the latter country. Taking the case of the Malaya sterling companies, page 65, had they produced the same crop per acre as the Cochin China estates their costs would have been just as low. But Cochin China possesses a more permanent advantage in the lenient labor legislation, cheaper opening costs, and freedom from taxation. Some of these advantages will tend to disappear in time.

The gray-soil estates in Cochin China have additional advantages in the ease with which they can secure labor from surrounding villages. There is no need for housing the labor on the estate; thus the cost of constructing and maintaining laborers' quarters is done away with. On the other hand, the yield from gray soil will probably not be so high as that from red.

ANALYSIS OF MISCELLANEOUS COMPANIES

Following is an analysis of three estates (Burma, Borneo, and Sumatra) under one control:

TABLE 24.—ANALYSIS OF MISCELLANEOUS ESTATES (UNDER SAME GROUP)[1]

Items	1919	1920	1921	1922
EXPENDITURE PER ACRE				
Estate expenditure (excluding depreciation, London charges, etc.):	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
Burma	£12.2	£14.2	£6.3	£6.6
Borneo	9.9	13.2	14.1	9.3
Sumatra	11.5	18.1	15.2	5.4
London administration charges:				
Burma	.64	.72	.60	.59
Borneo	1.12	1.41	1.50	1.45
Sumatra	1.23	2.28	2.11	1.55
EXPENDITURE PER POUND OF RUBBER				
Estate expenditure (excluding depreciation, London charges, etc.):	Pence per pound	Pence per pound	Pence per pound	Pence per pound
Burma	12.9	14.9	7.4	7.1
Borneo	11.0	11.0	10.3	6.8
Sumatra	8.1	9.5	10.6	4.2
AVERAGE YIELD OF RUBBER PER ACRE	Pounds	Pounds	Pounds	Pounds
Burma	227	229	205	224
Borneo	240	262	330	237
Sumatra	340	457	343	306

[1] Data relate to one estate in each country named.

The Philippine Survey party collected data on two additional Borneo estates for 1923.

TABLE 25.—ANALYSIS OF BORNEO ESTATES

Items	Estate A		Estate B	
	Per acre	Per pound of rubber	Per acre	Per pound of rubber
	Borneo dollars	*Borneo cents*	*Borneo dollars*	*Borneo cents*
Upkeep of producing area	6.22	1.57	2.63	0.70
Tapping and collection	19.64	4.96	18.79	5.01
Manufacturing and packing	11.48	2.90	10.05	2.68
General charges, including depreciation on buildings, machinery, etc	36.31	9.17	27.97	7.46
Total f. o. b. cost of production	73.65	18.60	59.44	15.85

The average yield per acre was 396 pounds for Estate A and 375 pounds for Estate B.

COMPARISON OF COSTS

Perhaps the chief reason why costs in different countries are not comparable during the last few years lies in exchange. (The violent fluctuation in the various currencies is discussed on page 83.) However, an attempt has been made to reach an approximation.

Sterling has been taken as a basis, because the additional fluctuation of the pound as compared with American currency would involve a double conversion, rendering the results even less accurate and comparable.

For Ceylon rupee companies, the rupee has been calculated at the following values: 1919—1s. 8.75d.; 1920—2s. 0.5d.; 1921—1s. 4d.; 1922—1s. 4d. Ceylon sterling companies keep their accounts in sterling, and there is no way of ascertaining the rates of conversion used. Figures should be interpreted with this in mind.

As there is practically no exchange fluctuation between the Straits dollar and the pound sterling Malayan companies offer no difficulties in conversion.

For companies in Netherlands India which keep their accounts in guilders, the following rates of conversion have been used: 1919—10.74 guilders to the pound sterling; 1920—10.86 guilders; 1921—11.49 guilders; 1922—11.50 guilders. At these rates the guilder equals: 1919—22.35d.; 1920—22.1d.; 1921—20.89d.; 1922—20.87d.

TABLE 26.—COMPARISON OF ESTATE EXPENDITURE

Companies	1919	1920	1921	1922
ESTATE EXPENDITURE PER ACRE	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
10 Ceylon rupee companies	£14.7	£19.2	£7.1	£7.8
13 Ceylon sterling estates [1]	19.1	22.3	10.0	9.4
19 Malaya dollar companies	14.3	16.5	9.1	8.5
27 Malaya sterling companies	14.2	16.7	11.4	7.4
11 Sumatra estates	12.9	17.7	14.2	9.9
49 Java estates	9.8	11.2	7.5	6.4
Average estate expenditure per acre	13.8	16.7	11.1	8.1
ESTATE EXPENDITURE PER POUND OF RUBBER	Pence per pound	Pence per pound	Pence per pound	Pence per pound
10 Ceylon rupee companies	9.5	11.8	4.8	4.6
13 Ceylon sterling estates [1]	11.7	13.7	7.4	6.0
19 Malaya dollar companies	9.4	10.5	8.4	5.9
27 Malaya sterling companies	10.6	11.4	9.8	6.7
11 Sumatra estates	10.0	14.0	12.0	7.2
49 Java estates	10.6	11.5	8.2	5.6
Average estate expenditure per pound	10.6	12.2	9.6	6.4

[1] These accounts were kept in sterling, and it is not known what rates of conversion were employed; it may be that they are not comparable with the other figures.

There are a number of interesting points in the above table. Every country shows a material increase in 1920 over 1919, with drastic reductions in the following two years.

Sumatra shows a considerable lag in reducing expenditures, which is what would be anticipated considering the fact that indentured labor is employed. Under the terms of the contracts with laborers it is very difficult to make a quick adjustment by discharging and repatriating excess labor.

The Java figures indicate that Java estates work at a lower cost than estates in other countries; even if the figures are comparable, there is some question as to whether the low costs may not be offset by other factors, such as yield of latex and irregularity of labor.

One large group having interests in both Sumatra and Java (though the former are much the more important) reports the f. o. b. costs for 1922 at 6.75d. for Sumatra and 7.25d. for Java. This was a reversal of conditions in the previous year, when Java led with 8.5d. against 10.5d. in Sumatra. The relative yields in 1922 were: Sumatra, 410 pounds of rubber per acre; Java, 351 pounds. These costs reflect the importance of yield, for the f. o. b. cost per acre was £11.5 in Sumatra and only £10.6 in Java.

TABLE 27.—AVERAGE YIELD PER ACRE

Companies	1919	1920	1921	1922
	Pounds	Pounds	Pounds	Pounds
10 Ceylon rupee companies	374	388	357	408
13 Ceylon sterling estates	393	392	327	377
19 Malaya dollar companies	365	376	260	349
27 Malaya sterling companies	322	351	278	264
11 Sumatra estates	284	303	284	330
49 Java estates	221	235	223	274

Some of the Malaya sterling companies give a yield per mature acre, not per acre in bearing. The Malaya companies did more restricting of output in 1922 than the Ceylon companies. Thus, the variations in costs of production must be interpreted in the light of special circumstances. For example, though the estate cost of production per pound for Ceylon companies is lower than that of Malaya companies, the cost per acre of Malaya sterling companies is lower than that of Ceylon companies; so that the cost per pound of rubber would have been less in Malaya than in Ceylon had the Malaya companies produced the same crop per acre.

TABLE 28.—UPKEEP OF PRODUCING AREA PER ACRE

Companies	1919	1920	1921	1922
	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
19 Malaya sterling companies	£2.47	£2.73	£1.54	£1.00
11 Sumatra estates	1.77	1.82	2.28	2.46
49 Java estates	2.12	2.50	1.18	.89
Average	2.12	2.32	1.72	1.46

The trend in the groups above for which details are available is quite different. While all show an increase in 1920 over 1919, Malaya and Java show a subsequent falling off against a rise in Sumatra. This may be explained partially by the drastic economies effected in these two countries, resulting, no doubt, in some upkeep work being neglected; on the other hand, it is believed that some extraordinary expenditure was incurred on the Sumatra estates.

TABLE 29.—TAPPING AND COLLECTION COSTS PER POUND OF RUBBER

Companies	1919	1920	1921	1922
	Pence per pound	Pence per pound	Pence per pound	Pence per pound
18 Malaya sterling companies	3.2	3.2	2.4	1.5
11 Sumatra estates	2.8	3.1	3.3	2.9
49 Java estates	3.6	3.7	2.5	1.5
Average	3.1	3.3	2.8	2.1

All groups show an increase in 1920 over 1919. Malaya and Java fall off rapidly, while Sumatra increases slightly in 1921 and decreases in 1922. The reductions in Malaya and Java are largely due to altered tapping methods, substituting alternate-day or periodic tapping for daily. Here again Sumatra lagged behind, and it was not until 1923 that some of the properties represented in the above costs adopted alternate-tapping systems. This accounts for the fact that 1922 costs were nearly double those of Malaya and Java.

TABLE 30.—MANUFACTURING, PACKING, AND F. O. B. SHIPPING CHARGES PER POUND OF RUBBER

Companies	1919	1920	1921	1922
	Pence per pound	Pence per pound	Pence per pound	Pence per pound
18 Malaya sterling companies	1.6	1.8	1.7	1.3
11 Sumatra estates	.6	.5	.8	.6
49 Java estates	2.1	2.0	1.8	1.6
Average	1.2	1.2	1.3	1.0

The most interesting feature of the above table is the relatively low cost of manufacturing, packing, and shipping in Sumatra as compared with Malaya and Java. This is due to the large-scale operations and centralized manufacturing which exist in Sumatra.

TABLE 31.—GENERAL CHARGES PER ACRE

Companies	1919	1920	1921	1922
	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
19 Malaya sterling companies	£4.32	£6.03	£4.79	£3.20
11 Sumatra estates	7.12	11.40	7.10	2.72
49 Java estates	2.46	3.07	2.44	2.07
Average	5.19	7.54	5.16	2.75

Unfortunately, the Java estates have other crops besides rubber, and it is impossible to know whether rubber bears its proper proportion of general charges. From the above table, this seems doubtful.

Sumatra was expensive to start with, but when economies were put into force general charges fell below Malaya's figures and, so far as the larger groups are concerned, are likely to remain below Malaya.

TABLE 32.—DEPRECIATION ON BUILDINGS, MACHINERY, ETC., PER ACRE

Companies	1919	1920	1921	1922
	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
10 Ceylon rupee companies	£0.82	£0.70	£0.53	£0.46
13 Ceylon sterling estates	.58	.52	.54	.50
16 Malaya dollar companies	.89	.92	.85	.78
21 Malaya sterling companies	1.10	1.10	1.12	.97
11 Sumatra estates	.62	.82	.88	.80
49 Java estates	1.11	.93	.99	1.07
Average	.87	.90	.93	[1] .86

[1] Reduced to a cost per pound basis and added to "Estate expenditure," Table 26, this gives an f. o. b. cost of 7.08d. for 1922.

The above table shows marked variation in the amount of depreciation charged off each year by different companies. The low charges in Ceylon are probably due partially to the fact that laborers' quarters generally are not of the same type of permanent construction as elsewhere; these charges will rise in future because of the new building regulations put in force in 1923, requiring much more costly construction.

There is reason to believe that depreciation on some Malaya dollar estates was omitted or reduced to a minimum during the depression. The depreciation figures for the Malaya sterling companies and the Sumatra and Java estates are believed to be representative and reasonable.

TABLE 33.—DEPRECIATION ON RUBBER AREA PER ACRE

Companies	1919	1920	1921	1922
	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
			£2.21	£2.84
10 Sumatra estates	£0.90	£2.45		
14 Java estates		1.03	1.02	1.08

Of all the reports analyzed, only two groups include depreciation on the rubber trees and concessions. This depreciation will naturally vary with the original cost of the estates and the rate. Sumatra shows a higher depreciation than Java, which is to be expected because of the higher development costs in the former country.

TABLE 34.—BONUS TO STAFF PER POUND OF RUBBER

Companies	1919	1920	1921	1922
	Pence per pound	Pence per pound	Pence per pound	Pence per pound
14 Malaya sterling companies	0.22	0.23	0.11	0.09
19 Sumatra estates	1.27	.10		.11
35 Java estates	1.27	.72	.52	.69

In Sumatra and Java a staff bonus or profit-sharing plan is a recognized charge against profits. This practice is not general elsewhere, but is certain to be adopted to a wider extent as profits increase in future.

TABLE 35.—HEAD-OFFICE EXPENSES, DIRECTORS' FEES, ETC., PER ACRE

Companies	1919	1920	1921	1922
	Sterling per acre	Sterling per acre	Sterling per acre	Sterling per acre
10 Ceylon rupee companies	£0.52	£0.64	£0.39	£0.39
13 Ceylon sterling estates	.48	.64	.58	.60
13 Malaya dollar companies	.62	.63	.55	.65
29 Malaya sterling companies	.68	.86	.86	.74
11 Sumatra estates	1.24	.82	.64	.52
14 Java estates	.69	.71	.69	.57
Average	.83	.78	.71	.61

Of the six groups the Ceylon rupee companies show the lowest head-office expenses and the Malaya dollar companies stand third. This indicates that it costs more to maintain headquarters at home than in the East.

The second lowest is the Sumatra group, which again reflects the economies of large-scale units.

The most expensive properties to administer are those controlled from London. It is interesting to note in this connection the London administration expenses of the three companies in Burma, Borneo, and Sumatra, page 69, which show costs of £0.59, £1.45, and £1.55, respectively, for 1922.

TABLE 36.—FREIGHT, INSURANCE, ETC., TO LONDON OR NEW YORK PER POUND OF RUBBER

Companies	1919	1920	1921	1922
	Pence per pound	Pence per pound	Pence per pound	Pence per pound
13 Ceylon sterling estates	1.04	1.40	0.58	0.52
16 Malaya sterling companies	2.00	1.86	1.23	.95
10 Sumatra estates	1.81	1.15	.61	.38

Freight, insurance, etc., show a steady decline, due chiefly to reductions in freight charges by the shipping companies.

TABLE 37.—CORPORATION AND INCOME TAXES PER POUND OF RUBBER

Companies	1919	1920	1921	1922
	Pence per pound	Pence per pound	Pence per pound	Pence per pound
18 Malaya sterling companies	2.67	2.26	2.21	2.10
11 Sumatra estates	.56	.86	.72	

At first sight the above figures would indicate that Malaya was a more expensive place to operate than is Netherlands India. There are two important points to remember in this connection: (a) Netherlands India taxes will increase rapidly as profits increase; and (b) a corporation operating in Netherlands India will have not only the Indian taxes to pay but the home taxes as well. Thus, a British or American corporation owning estates in Netherlands India would have to pay taxes both in the East and in England or America.

The foregoing costs have been compiled by direct reference to company reports. A further compilation appears below. The data for this were taken from a booklet issued by a London firm in which an attempt was made to arrive at actual all-in costs, as shown by the following quotation:

The term "all-in costs," in the sense which we have used it, comprises all estate expenditure (other than capital expenditure), staff bonuses, allowance for depreciation of buildings and machinery, freight to London or New York, marine insurance, dock charges, and brokers' and agents' commission, as well as directors' fees and cost of London office administration. In some cases where we have been obliged to estimate one or more of these items our "all-in" figures may differ from those quoted in the company's annual report. It should be stated, too, that in arriving at the profit for the year we have deducted interest on loans, debenture interest, foreign income tax, and (if known) British corporation tax, but not British income tax or excess-profits duty.

As will be noted, these costs do not cover depreciation on planted area, nor do they include items such as interest on loans and debentures or foreign and domestic taxation, which, under the usual accounting systems, are treated as allocation of profits and not as cost of production.

TABLE 38.—ALL-IN PRODUCTION COSTS OF STERLING COMPANIES

Location	1919		1920		1921		1922	
	Com-panies	Cost per pound	Com-panies	Cost per pound	Com-panies	Cost per pound	Com-panies	Cost per pound
	No.	Pence	No.	Pence	No.	Pence	No.	Pence
Malaya	64	13.12	64	14.48	64	10.70	60	8.43
Ceylon	12	14.59	14	16.49	13	8.65	13	7.46
Java	8	13.74	8	16.04	8	13.39	8	10.23
Sumatra	10	16.24	10	17.89	10	14.28	10	9.42
Netherlands India combined	18	15.11	18	17.14	18	13.92	18	9.74
South India	5	16.18	5	17.29	5	10.37	5	7.53
Burma	3	16.67	3	17.04	3	11.96	3	9.08
British North Borneo	12	14.81	12	14.14	12	13.34	12	9.22
Dutch Borneo	2	21.47	2	16.99	2	16.22	1	10.75

FUTURE COSTS OF PRODUCTION

Under the present system of organization, expenditure is about at its minimum, efficiency about at its maximum. With a recovery in the price of rubber and a lifting of the export restriction, future trends will be upward in most instances.

Upkeep of producing area.—Wages generally may be expected to rise. There is constant agitation going on in India which will be reflected in Ceylon and Malaya. The Chinese in Malaya may be expected to exert pressure for higher wages as opportunities arise. Wages in Sumatra may revert to the 1919–20 levels. Accompanying increased wages anywhere is decreased efficiency. Furthermore, larger crops, required by increasing demand, will result in more competition for labor, also forcing up wages.

There will probably be a permanent margin between the wages of the white race in a temperate climate and the wages of the colored races in the Tropics because of fundamentally different standards of living. Shelter and clothing requirements are much greater in the Temperate Zone and the growing and distribution of foodstuffs much more expensive.

Superintendence during the depression was cut down to a minimum and partially replaced by a native staff. Already some companies are reengaging white superintendence, but owing to new methods the amount of white superintendence will probably never revert to the former standards.

Cover crops are replacing clean weeding on slopes; the cost of upkeep, however, will not be changed materially. Diseases and pests will probably receive more attention in future than during the past few years. Upkeep of buildings, machinery, factory, roads, drains, bridges, fences, etc., and prevention of soil wash have undoubtedly been neglected on many estates; the large decrease in expenditure under "upkeep of producing area" is a clear indication of extraordinary economies in these directions; it can be anticipated that with a higher price for rubber expenditure will increase—but scarcely to the old levels.

Whether or not fertilizing improves yield, it is almost certain to be reintroduced widely in Ceylon as soon as finances permit.

It is believed that £1.50 per acre is ample to cover "upkeep of producing area."

OTHER EASTERN EXPENDITURES

Tapping and collection.—This item may increase slightly when the lower-yielding areas are brought back into the tapping rounds; 1.5d. is allowed for this.

General charges.—Overheads, such as salaries and indirect labor charges, are likely to show increases unless estates are consolidated into larger groups. Indirect labor charges will increase with the resumption of recruiting on a larger scale. It is believed that £3 is a fair figure for this item.

Export taxes.—This is taken at the prevailing rate in Malaya, viz, 2 Straits cents (0.57d.) per pound of rubber.

Depreciation on buildings, machinery, etc.—This will probably receive more generous treatment in future. A figure of £0.90 is used to cover this item. On new areas opened up the figure should be smaller because of the smaller expenditure under this heading.

FREIGHT AND INSURANCE

Freight, insurance, and other charges to consuming markets.—Freight rates will no doubt increase in future.[4] Figure 50 (below) indicates how rates have fluctuated in the past.

If rubber is shipped from Malaya to London for sale, at present rates freight, insurance, London dock charges, etc., will amount to about 1d. per pound. Charges from London to New York are roughly 0.5d. Shipped direct from Singapore to New York, the charges would be only 0.375d. An average cost of 1d. per pound will be used.

HOME CHARGES

Head-office charges.—It is not unlikely that these may show a slight increase as profits increase. A figure of £0.70 per acre is used.

Depreciation on rubber area and concessions.—A number of estates are making provision against the future of their rubber area, either by building up an amortization fund or by opening a small area annually, charged to revenue. Some estates are beginning to write off depreciation on their concessions.
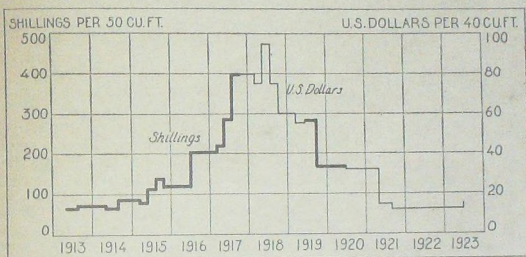

FIG. 50.—Fluctuations in the freight rate on rubber between Singapore and New York

From a financial point of view the building up of a liquid reserve fund against contingencies would seem to be desirable. The industry has been very lax in the matter of liquid reserves.

If an acre of rubber (excluding buildings, factory, etc.) is taken as worth £50, a 30-year depreciation involves an annual write-off of £1.7 per acre. This figure is used as reasonable.

GENERAL FACTORS INFLUENCING COSTS

The cost of future factory installations can be reduced considerably, as many estates have been unnecessarily extravagant in this respect. Increasing quantities of rubber in the form of latex are being marketed locally. Future planters adopting this method of marketing entirely would not be under the necessity of erecting factories, thus making savings in capital costs and in cost of preparing the rubber for market.

Practically all the present area has been planted with unselected stock. Recent scientific methods indicate that planting with selected seed or budded stock will result in larger yields per acre, thus reducing the production cost per pound. Newly opened plantations taking advantage of such methods will thus be in a better position to compete with those already established.

[4] At the end of April, 1924, freight rates to London from both Singapore and Colombo were increased.

The permanent economies which have been effected during the depression are chiefly in the altered methods of tapping—periodic instead of daily—with a smaller labor force. Malayan costs were also lowered through a temporary stoppage of the export duty and the Indian labor assessments. Many of the other economies are of a temporary nature.

Aside from the influences on costs mentioned above, not much decrease can be anticipated by reverting to unrestricted production, since, as stated in the letter referred to on page 51 "we can not produce full crops there [in Netherlands India] any cheaper per pound than we have brought down the cost of our restricted crops [Malaya], because we have been tapping only the best yielding areas and trees."

This authority further said that after examining 80 or 90 reports of rubber-plantation companies he found the average cost of production of Malayan companies, all-in London, in 1922 (a year of severe economies) to be 8.5d., without any export duty for 10 months of the year. The very lowest all-in cost was 6d. He added that though there was some restriction in 1922 it was "not possible to think of maintaining costs even of a full crop at below the actual cost of 1922."

ESTIMATED FUTURE COST OF PRODUCTION

By assembling the previous estimates, a total is secured which might be termed a "standard" cost of production, under normal conditions, for a London company operating in Malaya, with an average yield of 400 pounds per acre.

TABLE 39.—ESTIMATED FUTURE COST OF PRODUCTION

Items	Cost per acre	Cost per pound of rubber [1]	
		British currency	U. S. equivalent [2]
	Sterling	*Pence*	*Cents*
1. Upkeep of producing area	£1.50	0.90	1.61
2. Tapping and collection	2.50	1.50	2.69
3. Manufacturing, packing, and f. o. b. shipping charges	2.50	1.50	2.69
4. General charges	3.00	1.80	3.23
5. Local export taxes	.93	.56	1.00
6. Estate expenditure	10.43	6.26	11.22
7. Depreciation on buildings, machinery, etc	.90	.54	.97
8. F. o. b. cost of production	11.33	6.80	12.19
9. Freight, insurance, etc., to consuming markets	1.67	1.00	1.79
10. Head-office charges	.70	.42	.75
11. Usual all-in cost of production	13.70	8.22	14.73
12. Depreciation on rubber area	1.70	1.02	1.83
13. Grand total	15.40	9.24	16.56

[1] On the basis of a yield of 400 pounds of rubber to the acre.
[2] Converted at $4.30 to the pound, which rate is fixed in all conversions herein of sterling to American gold except where otherwise stated. The par value is $4.8665. Since this report was prepared the pound has been gradually approaching par and all conversions from sterling to U. S. currency should be revised accordingly. For example, at $4.73 to the pound—the rate in January, 1925—the American-currency figures would need to be increased by 10 per cent. See also page 83 following.

Before the shareholders are entitled to a distribution of profits, two further items of expenditure are incurred, namely, corporation taxes and profit-sharing. Both will depend on the amount of profits made; if no profits are made, there will be no expenditure on these items. For the four years 1919–1922 the Malaya companies registered in London paid on an average over 2d. a pound in home taxes. With a material rise in the price of rubber, Dutch taxation will be higher still. As to profit-sharing, it is believed that companies operating outside Netherlands India·will be obliged to follow the precedents established there in the way of giving their staffs a share in the profits. A distribution of 10 per cent is not excessive; in Netherlands India many companies give more than this. Taxes are not deducted from profits before computing the share due employees. The following calculation gives a rough estimate of the cost per pound of rubber of a profit-sharing system based on an average yield of 400 pounds to the acre:

	Pence
Selling price, taken at	18.00
Cost of production (as above)	9.24
Profit per pound	8.76
Employees' share at 10 per cent	.876

PAST COSTS AS A COMPARISON

It is of interest to note here that despite the drastic economies effected during the last few years the total revenue expenditure per pound of rubber of the 12 Malaya sterling companies analyzed on page 64 (which group is one of the best guides to present-day costs) was as follows:

	Straits cents	British pence
1919	63.18	17.7
1920	65.42	18.3
1921	55.65	15.6
1922	42.38	11.9

These totals include corporation and income taxes but exclude miscellaneous receipts such as transfer fees and interest on bank deposits; they also exclude depreciation on rubber area, which, if included, would add 1d. per pound.

POSSIBLE ECONOMIES

The potential American investor in plantation rubber will be interested in the possibilities of effecting savings in present methods.

·In the group of 13 Malaya sterling companies under centralized control, with two exceptions the smallest estates were the most expensive to operate, the largest the cheapest. This is well illustrated by Figure 51 (see p. 80).

In the preceding analyses of costs, split up under separate headings, numerous instances came to light showing how the large units were operating at lower cost than the small. Granting equal conditions, and assuming that operations were carried out on a very large scale, it is believed that permanent savings could be effected under such headings as manufacture, general charges, depreciation, freight and insurance, and head-office charges, which in the aggregate would approximate 2d. a pound. During a period of restricted output, such as at present, additional temporary savings, bringing this figure up to 2.5d. per pound of rubber, are entirely possible.

Calculations made some years ago, based on a large number of companies chosen indiscriminately, indicated that 20 per cent had less than 500 acres planted, 50 per cent less than 1,000, and 80 per cent less than 2,000.

RATIO OF WAGES TO COST OF PRODUCTION

In the following analysis, "revenue expenditure" means all expenditure in the East, including estate cost, depreciation on buildings and machinery, and f. o. b. shipping charges; but it does not include head-office charges, freight and insurance to consuming markets, staff profit-sharing, corporation taxes, and depreciation on rubber area. There is an exception to this in the case of 14 estates in 1923, where revenue expenditure includes head-office charges
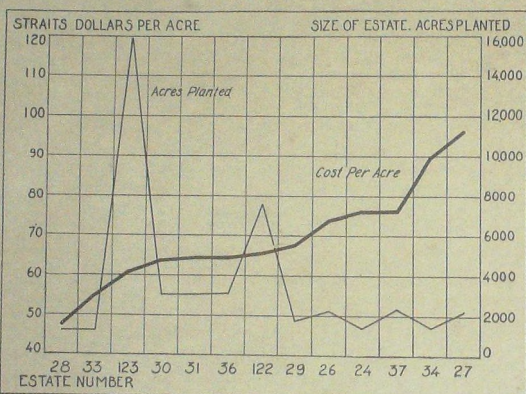

Fig. 51.—Comparison of cost of operation with size of estate; 13 Malaya sterling companies under centralized control

and depreciation on rubber area; these charges could not be deducted because the exact figures were not available; this lack of uniformity, however, will not affect the percentage materially.

The proportion of wages to cost of production varies considerably between different estates. Figures covering 24 estates for the years 1918 and 1919 gave an average percentage of wages to revenue expenditure of 47, and for 55 estates in 1922 and 1923 the average worked out at 37 per cent. This shows a drop in percentage of wages paid, which was to be anticipated because of the reduced labor forces made possible by the adoption of alternate-day or periodic tapping.

Undoubtedly there are differences in the accounting methods by which the above figures were computed; furthermore, the average is an average of a series of percentages, as the figures of actual expenditure were not available; the result, however, is sufficiently accurate for all practical purposes.

On a return to more normal conditions and with the lifting of the export restriction, it is possible that wages will average around 40 per cent of revenue expenditure.

WAGES EXPRESSED IN PERCENTAGES

In the "estimated future cost of production," page 78, the figure corresponding to "revenue expenditure," as defined on page 80, is 6.80d. per pound of rubber. If wages are taken as 40 per cent, or 2.72d., wages alone would work out at 33.1 per cent of the usual all-in cost of production (8.22d.).

On page 55 it was found that wages ranged from 60 to 65 per cent of total labor charges, including indirect labor charges. Taking the figure of 60 per cent, it is found that total labor charges, based on wages of 2.72d. per pound of rubber, work out at 55.1 per cent of the usual all-in cost of production (8.22d.).

As an example of how the class of labor affects the wage percentage, following is a comparison of six estates (under the same control), three with Tamil labor only, and three with mixed forces of Chinese and Tamil:

TABLE 40.—PERCENTAGE OF WAGES TO REVENUE EXPENDITURE

Tamil labor only	1918–19	1922–23	Chinese and Tamil labor	1918–19	1922–23
	Per cent	Per cent		Per cent	Per cent
Estate A	39	31	Estate D	52	41
Estate B	36	35	Estate E	50	38
Estate C	32	30	Estate F	60	44

The above shows clearly how the more expensive Chinese affect the wage percentage, especially in a time of labor stringency such as existed in 1919.

LABOR AND SUPERINTENDENCE

As mentioned elsewhere, the most important influence on reduction of costs during recent years has been the smaller labor force and superintendence made possible by altered systems of tapping. The following table shows the labor force in the Federated Malay States, as given by the Labor Department, the acreage planted, and the acres per laborer. It should be noted that much of the work done on estates other than tapping is under contract with Chinese, who would not always appear in the figures of labor force; also that a third of the area in the Federated Malay States is in small holdings, many of which would employ no labor other than that of the owner.

TABLE 41.—ACRES PER LABORER IN FEDERATED MALAY STATES

Years	Estate labor, all classes	Acres planted	Acres per laborer	Years	Estate labor, all classes	Acres planted	Acres per laborer
1915	171,000	692,000	4.1	1919	237,000	1,148,000	4.8
1916	196,000	791,000	4.0	1920	217,000	1,211,000	5.6
1917	221,000	959,000	4.3	1921	156,000	1,235,000	7.9
1918	202,000	1,053,000	5.3	1922	167,000	1,258,000	7.5

Estate records of 30 estates gave an average at the end of 1919 of 2.4 acres per laborer, and of 33 estates an average at the end of 1922 of 4.5 acres per laborer.

In India and Burma the acres per laborer (including temporary employees) was 2.2 in 1920, 4.1 in 1921, and 4.2 in 1922.

On 18 estates the number of white superintendents was reduced from 206 in 1919 to 125 in 1922.

MEDICAL COST PER LABORER

Medical cost per laborer varies with the locality and healthfulness of the property. The range over 12 estates under the same management was from $4.20 to $27.87 Straits per laborer in 1922, with an average of $17.58; or, at 5.1 acres per laborer, $3.45 per acre per year. On an estate belonging to another group, sanitary measures to keep down malaria are costing at the rate of 10 Straits cents per laborer per day, or between $30 and $35 Straits per laborer per year. On three other estates the 1923 estimates called for an annual expenditure of $9.25, $10.56, and $13.70 Straits per laborer for hospital and medical costs.

The following table gives the medical costs during the last four years for 11 estates under another managerial group:

TABLE 42.—ANNUAL HOSPITAL AND MEDICAL EXPENDITURE PER LABORER, 11 MALAYA ESTATES

Estates	1919	1920	1921	1922	Estates	1919	1920	1921	1922
	Straits dollars	Straits dollars	Straits dollars	Straits dollars		Straits dollars	Straits dollars	Straits dollars	Straits dollars
A	51	60	28	25	G	9	15	12	12
B	8	8	7	5	H	8	9	12	16
C	100	104	44	23	I	15		22	18
D	24	25	22	17	J	16		21	15
E	6	8	8	7	K			20	18
F	20		21	16					

The expenditure per pound of rubber on some of the estates in this group has dropped from 10 cents to around 3 cents on the unhealthful estates.

The following table covers 9 Sumatra estates:

TABLE 43.—HOSPITAL AND MEDICAL EXPENDITURE PER LABORER, 9 SUMATRA ESTATES

Estates	1922		1923 (9 months)	
	Cost per laborer	Cost per acre	Cost per laborer	Cost per acre
	Guilders	Guilders	Guilders	Guilders
A	18	3.32	14	2.51
B	14	2.80	10	2.05
C	26	4.83	16	2.99
D	21	3.90	19	3.42
E	26	4.73	17	3.06
F	21	4.37	11	2.35
G	15	2.95	12	2.40
H	20	3.53	15	2.57
I	25	5.61	17	3.85
Average	20	4.35	15	3.27

INFLUENCE OF EXCHANGE IN COSTS

A factor which has influenced costs enormously during the past five years has been exchange.

The following table and diagram show the fluctuation of the rupee (Ceylon, Burma, and India), the Straits dollar (Malaya), the guilder or florin (Netherlands India), the piaster (Indo-China), and the British pound sterling as expressed in American currency. The price of silver is also shown.

TABLE 44.—FLUCTUATIONS IN THE EASTERN EXCHANGES, THE POUND STERLING, AND THE PRICE OF SILVER, AS EXPRESSED IN UNITED STATES CURRENCY

Years	Rupee (par $0.3244 [1])			Straits dollar (par $0.567758)			Netherlands India guilder (par $0.402)		
	High	Low	Aver-age	High	Low	Aver-age	High	Low	Aver-age
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1913									
1914									
1915							41	39	40
1916							42	40	41
1917							42	40	41
1918				[2] 58	55	56	52	42	46
1919	46	36	40	56	44	52	42	37	39
1920	48	27	39	49	38	42	38	29	35
1921	29	23	26	48	41	44	35	30	33
1922	31	28	29	53	48	51	39	36	38
1923	32	30	31	55	51	53	39	36	38

Years	Indo-China piaster [3]			Pound sterling (par $4.8665)			Price of silver per ounce		
	High	Low	Aver-age	High	Low	Aver-age	High	Low	Aver-age
	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents	Cents
1913							64	59	61
1914				512	483	486	60	51	56
1915	46	43	45	486	456	479	56	49	51
1916	55	44	49	479	474	477	77	58	67
1917	78	54	63	479	477	477	107	75	84
1918	86	66	75	478	476	477	102	90	98
1919	106	75	90	477	367	443	135	102	112
1920	123	46	81	403	323	366	134	66	102
1921	55	42	51	423	353	385	71	57	63
1922	59	50	56	468	419	443	72	64	68
1923	55	49	53	472	428	459	68	63	65

[1] In September, 1920, the rupee was officially fixed at 10 to the pound sterling ($0.48665), but for practical trade purposes it is still taken at 15 to the pound ($0.3244).
[2] Five months.
[3] The value of the piaster is based on its silver content. It is therefore subject both to silver and to trade fluctuations.

RUPEE, STRAITS, AND GUILDER EXCHANGE

Ceylon and India.—In Ceylon and India the rupee, which had for many years been stabilized around 1s. 4d., rose to 2s. 10d. in February, 1920. Since that date it has fallen back to normal, although the official value is still nominally 2s.

The Ceylon rupee follows the course of the Indian rupee. The chief cause of the fluctuation in Indian exchange was the disruption of trade caused by the war. A contributory cause was the price of silver. A report of the Manchester (England) Association of Importers and Exporters says that pre-war stabilization rested on a well-
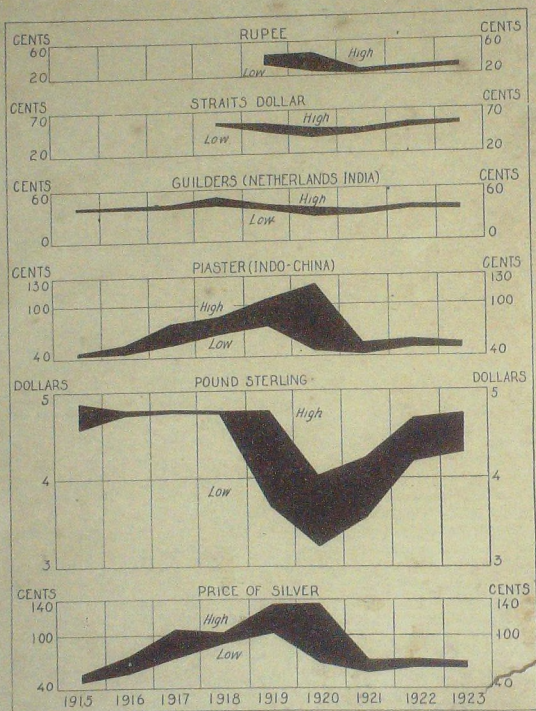
FIG. 52.—Fluctuations in the Eastern exchanges, the pound sterling, and the price of silver as expressed in United States currency

established equilibrium in the balance of trade. To steady exchange the Indian Government sold council and reverse council bills [5] freely and for years maintained the rupee at 1s. 4d. If exports declined, or if there was an excess of imports, the outflow of gold which followed caused a contraction of bank reserves; the banks curtailed credit, and a drop in prices followed; imports were checked in consequence, and exports stimulated, the process leading to a restoration of the equilibrium.

An average annual export surplus before the war of 720,000,000 rupees became 1,110,000,000 rupees in the fiscal year 1919–20; but in the following year conditions were reversed, and there was an import surplus of 810,000,000 rupees.

The chief point of interest is that with reasonable stability in trade exchange between India and London can be stabilized, and the relation of the rupee to the American dollar will depend on the cross rate, as in the past.

Malaya.—In Malaya the value of the Straits dollar, which had been steady for many years, did not alter during the war in relation to sterling. To counter the effect of high silver prices, the silver content of the dollar was reduced, only a limited quantity was allowed to circulate, and paper money was issued. The value of the Straits dollar in relation to the American dollar, par $0.567758 U. S., fluctuates with the cross rate.

Netherlands India.—The Netherlands India guilder, which is worth 40.2 cents U. S. at par, rose to about 52 cents in 1918, and then fell to 30 cents at the end of 1920, recovering to normal in early 1922, since which time it has been fairly steady. At the end of 1923 political conditions in Europe unsettled exchange, and the immediate future is obscure.

PIASTER EXCHANGE

Cochin China.—Prior to the war (from 1910 to 1914, inclusive) the piaster fluctuated approximately between 2.20 francs and 2.65 francs, varying almost in direct ratio to the price of silver. At the beginning of 1915 it started on a rapid upward course, which continued until February, 1920, when the piaster was worth 16.50 francs—nearly seven times as much as the pre-war average. It then dropped abruptly until May, 1921, when it reached 5.40 francs. By October it was over 8 francs, but fell back to under 6 francs in March, 1922.

From that date it broke away from the downward trend of silver and showed a steady rise to about 9 francs at the end of 1923, averaging 8.40 francs for the year. This indicates the kind of problem with which plantations incorporated in France have had to contend during the last 10 years. Tremendous losses in exchange were incurred.

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[5] *Councils and reverse councils in India.*—As the Government requires to remit money to London to meet the home charges, this is done by the secretary of state selling in London what are called council bills. A bank in London, having a balance of payments which must be remitted in money to India, buys a council bill from the secretary of state entitling it to receive so many thousands of rupees from the Government treasury in Bombay, Calcutta, or Madras. This being posted to India and cashed settles the balance of payments so far as that bank is concerned. In like manner, when the balance of payments is against India it is necessary either to send gold or silver out of India or to buy from the Government in India bills payable in London, which are called "reverse councils" or "sterling bills." These bills are paid for in rupees at Government treasuries in India, and when sent to London they entitle the holder to be paid so many thousands of pounds English money out of the balances of the secretary of state, which are kept in the Bank of England.—Jevons, Money, Banking, and Exchange in J——lis.

TABLE 45.—ESTIMATE OF THE ACREAGE OWNED BY WESTERN NATIONS AND JAPAN

Ownership and location of holdings	Acreage planted	Per cent of European [1] area	Per cent of total area planted in East	European [1] capital invested	Per cent of European [1] capital invested
Great Britain:					
Ceylon	315,000				
India and Burma	[2] 107,000				
Malaya	1,136,000				
Netherlands India	[2] 269,000				
Borneo	47,000				
Total	1,874,000	65.4	43.6	$505,000,000	65.7
Holland:					
Netherlands India	535,000	18.7	12.5	130,000,000	16.9
Japan:					
Malaya	100,000				
Netherlands India	12,000				
Borneo	13,000				
Total	125,000	4.4	2.9	42,000,000	5.5
United States:					
Malaya	15,000				
Netherlands India	72,000				
Total	87,000	3.0	2.0	32,000,000	4.2
France and Belgium:					
Malaya	15,000				
Netherlands India	36,000				
Indo-China	83,000				
Total	134,000	4.7	3.1	30,000,000	3.9
Shanghai:					
Malaya	38,000				
Netherlands India	14,000				
Total	52,000	1.8	1.2	14,000,000	1.8
Denmark:					
Malaya	32,000				
Netherlands India	8,000				
Total	40,000	1.4	.9	11,000,000	1.4
Miscellaneous, excluding Chinese and native areas	[2] 17,000	.6	.4	5,000,000	.6
Grand total	2,864,000	100.0	66.6	769,000,000	100.0

[1] Including American and Japanese.
[2] There is insufficient information to permit of an accurate division between European and native rubber.
[2] Revised figures show 13,000 acres more in this classification.

DOMICILE OF CONTROL

The above table represents ownership only. If domicile (place of registration) be included, Great Britain will be found to control 75 per cent of the total area planted in the Middle East, made up as follows:

	Acres
Total area planted (including Asiatic-owned) in Ceylon, India, Burma, Malaya, British North Borneo, Sarawak, and Brunei, and other small territories under British protection	2,961,000
British-owned estates in Netherlands India	269,000
Total	3,230,000

. 2,901,000