RUBBER PRODUCTION IN NEW GUINEA AND PAPUA.

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Introduction.

In this survey it is intended to present the various aspects of rubber production in New Guinea and Papua. The survey will be published in several parts, of which this is the first, and will deal with the early development, present position and economic prospects of the industry.

The island of New Guinea is divided into three main divisions—

(1) Dutch New Guinea, in the west, which comprises about half of the total area of the island and consists of an estimated area of 151,789 square miles.

(2) The Territory of New Guinea which is the portion of old German New Guinea once known as Kaiser Wilhelm's Land or North East New Guinea, with an estimated area of 70,000 square miles.

(3) Papua, which was formerly British New Guinea, has an estimated area of 90,540 square miles and is the south-eastern quarter of the island.

Papua was annexed in April, 1883, and became a Territory of the Commonwealth of Australia in November, 1905; thus its period of development has extended over approximately 57 years.

The Mandated Territory of New Guinea has a totally different history. Protected by an Imperial Charter in 1885, the German New Guinea Company laid the foundations for a successful colony which later came under control of the German Government. The first plantation (coco-nuts) was laid out at Ralum at Blanche Bay, New Britain, in 1883, and two years later the first plantation was established at Finschhafen on the mainland.

The Territory of New Guinea was captured and came under Australian military control in September, 1914, and in May, 1921, civil administration was established throughout the Territory. The German Government had paid considerable attention to economic development and the expropriation of German nationals from New Guinea was provided for by the Peace Treaty. The development during the period of German occupation, the military occupation by Australia and the subsequent progress under civil administration has not been collateral with the development in Papua during the same period.

AREA OF BRITISH-CONTROLLED NEW GUINEA.

Mandated Territory of New Guinea.		Papua.	
	Square miles.		Square miles.
New Guinea, Mainland ..	69,700	Papua, Mainland	87,786
New Britain	14,600	Other islands (about 200) ..	2,754
New Ireland	3,340		
Bougainville and Buka Islands..	4,100		
Other islands (almost 600) ..	1,260		
Total Area	93,000	Total Area	90,540

Grand Total, Papua and Mandated Territory of New Guinea—
Area—183,540 square miles.
Dutch New Guinea :—
Area—151,789 square miles.

There are over 600 islands in the Mandated Territory of New Guinea, many of which are quite small. Lavongai, Manus and the Admiralty Islands, Witu or French Island, Kar Kar Island, are some of the most important, other than those already mentioned.

There is a significant difference between the insular distribution of the Mandated Territory and Papua, as only roughly 75 per cent. of the former compared with over 96 per cent. of the total area of the latter is situated on the mainland of New Guinea. That means that almost a quarter, or 25 per cent. of the total area of the Mandated Territory is found on the geological newer islands, compared with less than 4 per cent. of the total area of Papua. There are about 200 islands and islets in Papua but these are mostly small; the main groups are the D'Entrecasteaux Group, the Louisiades Archipelago, the Trobriand Islands and the Conflict Group.

The total area of the Mandated Territory is approximately 24,086,440 hectares or 59,493,507 acres. The proportion of arable land suited for plantation agriculture has not yet been determined. By June, 1938, approximately, 301,000 hectares or only 1.2 per cent. of the total area had been alienated and the percentage of the total area under European cultivation did not exceed .45 per cent. If 2 per cent. only of the total area was available for agricultural development, that would amount to 475,732 hectares or 1,175,058 acres, which is more than four times as much as the area at present under cultivation.

It is a reasonably safe conjecture that the labour available in New Guinea could not develop such an area of plantation agriculture. There is doubt as to whether the present area devoted to plantations could be doubled and the labour found for working it, while gold production continues alongside other development. It is problematical whether it would be possible to develop the area already alienated even after allowing for the proportion of unsuitable land present.

The total area of Papua is approximately 57,945,600 acres. At 30th June, 1939, 1,769,705 acres had been purchased from the natives but actually only 215,489 acres of surveyed land including 23,490 acres of freehold land were held by individuals and companies. In addition to this area, 172,226 acres of Crown land had been surveyed and this includes reserves and areas available for leasing, making a total of 387,715 acres which had been more or less effectively alienated. The purchase of the remaining 1,382,990 acres from the natives, later to be made available for the settlement of planters, oil and gold prospecting, essential reserves for Government purposes, native reserves, &c., is a scheme which could be very effectively applied in the Mandated Territory. This method of making land available and still allowing for native requirements has been in operation for a considerable time in Papua and has progressed considerably as for example, in 1912, 1,023,049 acres ($2\frac{3}{8}$ per cent. of the Territory) and in 1937, 850,000 acres had been allotted to Crown lands.

The area under plantation cultivation in Papua is a very small percentage of the total area, namely, a little over .1 per cent., which is less than one-quarter as much as the area under cultivation in the Mandated Territory. There is however, a very striking difference between the distribution of the areas under cultivation in the two Territories.

In Papua, by far the greater proportion of the agriculture is confined to the mainland, whereas, if such islands as Kar Kar (Dampier) Island and other islands are included, about 85 per cent. of the plantation development in the Mandated Territory is on the islands, the greater proportion or about 60 per cent. being on the Bismarck Archipelago. One is not in a position to state the exact percentage of Papuan plantations situated on the mainland but it would seem that possibly more than 85 per cent. of the development had occurred there.

There are several possible reasons for the proportionately greater development of Papuan agriculture on the mainland, but it is mainly because there is not such an area of fertile islands present in Papua. One fact which stands out, however, is that rubber planting, particularly away from the sea coast, has been the main reason why continued development has been possible in Papua.

Only 15 per cent. (approximately) or about 40,000 acres of the total plantations present in the Mandated Territory, are to be found on the mainland. Rubber, high-quality Arabica coffee, tobacco and similar crops will need to be grown to develop the mainland to a much greater extent. In this regard, it must be remembered that the mainland area of North-east New Guinea comprises 18,000 square miles less than the mainland area of Papua and, apparently, carries a denser population whose needs have to be met.

Climatology.

To say that New Guinea and the Netherlands East Indies are located in the tropics is a much too vague classification. Nowhere in Australia are there any areas comparable with the greater part of the Mandated Territory of New Guinea, though there are some limited savannah areas in Papua which are comparable with North Australia.

The expression "the tropics" usually covers the whole broad belt between the tropics of cancer and capricorn—or between 23° south and north latitude. Within this vast belt great differences of climate are found and the strip between 10° north latitude and 10° south latitude within which New Guinea lies (Rabaul is at about 5° south) is quite distinct from the regions flanking it on either side and may be appropriately termed "the tropical zone" in the special sense.

TABLE No. 1(*a*).—ANNUAL RAINFALL AT VARIOUS RUBBER DISTRICTS—PAPUA.

Year.	Abau.	Ioma.	Kemp Welch.	Kerema.	Kikori.	Kokoda.	Magigi (Rona Falls).	Koitaki-numu.	Samarai.
1913 ..	106.61*	159.94	54.39*	147.99*	46.75*	110.88*	..	..	92.29
1914 ..	79.02*	112.08*	43.70	70.80*	118.52	102.41*	..	..	62.38
1915 ..	89.33	172.47*	52.16	172.08	245.38	135.22*	..	..	84.49
1916 ..	38.09*	171.63*	73.58	117.83	312.33	158.57	..	..	133.56
1917 ..	47.03*	157.86*	64.10	113.36	238.60	141.23	..	..	179.02
1918 ..	46.16*	154.31	31.53	118.56	173.82	111.80*	..	..	115.73
1919 ..	84.56	159.36	40.03	128.21	223.02	125.76*	..	..	117.21
1920 ..	67.49	72.96*	46.09	115.44*	195.27	97.24*	..	..	36.93*
1921 ..	35.57*	..	31.12*	143.04	270.73	122.20*	..	..	127.81
1922 ..	65.07*	145.91*	45.77*	137.34	222.89	130.88	..	..	125.83
1923 ..	39.85*	88.61*	..	141.59	163.58	110.69*	..	..	99.28
1924 ..	62.75*	145.52	71.39	154.00	239.43	165.50*	..	..	90.48
1925 ..	103.46	121.16	60.42	152.41	209.31	156.49	..	..	89.39

* Incomplete.

TABLE No. 1(*a*).—ANNUAL RAINFALL AT VARIOUS RUBBER DISTRICTS—PAPUA—*continued.*

Year.	Abau.	Ioma.	Kemp Welch.	Kerema.	Kikori.	Kokoda.	Magigi (Rona Falls).	Koitaki-numu.	Samarai.
1926 ..	62.86	143.21	49.61	117.69	266.07	164.23	..	70.48	81.75
1927 ..	82.93	143.37*	64.51	162.83	231.53	150.87*	..	127	109.38
1928 ..	109.36*	165.38	58.68	171.45	217.55	127.27	..	97.77	107.67
1929 ..	65.99*	138.87	64.25	157.21	249.77	134.81	77.68	91.53	96.13
1930 ..	86.36*	75.16*	52.95	175.50	240.00	143.62	57.09	117.03	92.94
1931 ..	68.93*	169.65*	50.98	103.22	227.66	144.90	45.09*	88.38	59.28
1932 ..	79.80*	158.52	56.33	136.76	217.03	110.74*	76.08	94.20	70.33
1933 ..	89.81	198.90*	73.46	146.02	265.51	139.20*	113.37	..	88.23
1934 ..	110.02	182.77	91.03	153.25	251.56	139.20*	88.16	171.62†	141.21
1935 ..	86.24	158.38	42.41	140.85	241.89	86.45*	71.93	129.90	100.30
1936 ..	94.18	169.43	73.61	129.67	280.84	..	92.08	128.80	139.64
1937 ..	108.62	166.89	47.56	187.49	247.49	128.03*	75.67	114.72	114.37
1938 ..	92.82	150.49	59.44	152.32	219.07	131.48	83.77	..	120.54
1939 ..	112.67*	120.61	52.21	157.66	288.68	121.06	81.87*	..	..
1940 ..	..	..	..	..	..	..	..	..	..

* Incomplete.
† Record 40 inches above average for previous ten years.

TABLE No. 1 (*b*).—PAPUA: AVERAGE MONTHLY RAINFALL RECORDS AT SELECTED STATIONS.

Station.	Number of Years.	January.	February.	March.	April.	May.	June.
Abau	10	6.47	6.53	8.72	9.31	10.33	9.27
Buna Bay	24	13.43	12.61	13.14	11.73	9.23	7.71
Ioma	17	17.27	15.25	15.40	11.96	10.72	9.57
Kemp Welch	24	8.07	6.50	8.36	8.54	4.07	2.42
Kerema	23	9.44	8.09	10.68	11.26	16.92	16.33
Kikori	24	11.49	12.57	15.25	17.47	30.23	30.51
Kokoda	10	12.95	12.05	16.02	13.64	12.93	7.61
Orangerie Bay ..	25	8.32	8.49	9.93	7.95	8.43	7.92
Rigo	21	6.67	4.54	7.73	5.61	2.42	2.29
Port Moresby* ..	38	6.99	7.57	6.64	4.22	2.50	1.26
Samarai	29	6.92	7.33	10.04	9.76	12.01	11.35

* Savannah Zone—not suited to rubber.

Station.	July.	August.	September.	October.	November.	December.	Yearly.
Abau	10.04	8.10	5.71	4.46	4.93	5.72	89.59
Buna Bay	5.47	4.41	5.72	9.12	13.44	14.60	120.61
Ioma	6.82	9.20	10.69	11.95	18.50	18.43	155.76
Kemp Welch	1.53	1.51	2.18	2.97	4.77	6.83	57.75
Kerema	13.12	13.93	12.47	12.32	9.27	7.35	141.18
Kikori	25.46	21.31	23.90	17.34	13.94	11.79	231.26
Kokoda	6.53	9.50	10.56	11.31	14.41	14.99	142.50
Orangerie Bay ..	8.43	8.28	6.00	5.04	3.98	5.74	88.51
Rigo	1.44	1.53	1.44	1.71	2.93	4.00	42.31
Port Moresby* ..	1.10	0.66	1.04	1.38	1.91	4.42	39.69
Samarai	8.08	8.61	10.13	8.71	8.40	5.37	106.71

Kanosia, another rubber area, showed an average yearly rainfall of 60 inches over eight years. Sogeri (Central) for six years, showed an average yearly rainfall of 108 inches.

The first thing to realize is that in New Guinea the seasons do not vary in the same way as they do in Australia or Europe. Summer and winter are not experienced and the days and nights all over New Guinea are each about twelve hours long all the year round. The sun here ascends and descends almost vertically and the periods of dawn and dusk are always short. In New Guinea the thermometer rarely goes over 90° F. and at 100° F. it is a hot day. One feels distinctly cold when the temperature, as it rarely does, descends to 60° F., at low levels. The daily temperature variation is generally so slight that even at a depth of one metre the soil shows no variation in temperature at all.

In Europe a constant soil temperature could only be expected at about ten times this depth.

Seasonal Behaviour of Plants.—The astounding fact that one cannot explain by any of the known theories of photo-periodism or growth theories is that such trees as *Eugenias,* rubber (*Hevea brasiliensis*), *Sideroxylon* and many other types behave seasonally, lose their leaves entirely within a few days in some cases. Flowering and growth, in such species, is most rapid and one has noticed many feet of growth to take place almost within one week. This feature is much more pronounced than with any deciduous trees in Australia.

Papua and New Guinea are situated well within the monsoonal belt and experience north-west and south-east seasons respectively, but they are outside the hurricane zone.

There is an excellent publication on rainfall observations and the climatology of Papua and the Mandated Territory of New Guinea, published by the Commonwealth Bureau of Meteorology in 1940.[1] In this, Hogan gives a brief survey of the weather of Papua and Challis of the New Guinea climate. It is difficult to give an account of the seasonal distribution of rainfall on account of the great variability in type and amount, respectively. This is well illustrated by reference to Tables Nos. 1 and 2 and comparing, say, Kikori with an average rainfall of 231.26 inches per annum, falling on 263 rainy days with stations like Kemp Welch with a 57.75 inches average annual rainfall on 112 rainy days, or Port Moresby, 39.69 inches average annual rainfall on 105 rainy days. It will be seen that there is generally a good rainfall on the coast of Papua and that the rubber districts are mainly found in areas of heavy rainfall, although the actual amount varies greatly according to station. The Kemp Welch Government Plantation does suffer from occasional drought and this is one of the lowest rainfall areas tabulated, with the exception of Port Moresby.

Kokoda is an example of an inland station at the base of Mount Victoria which receives 130 inches per year with a maximum precipitation in the north-west season mainly due to heavy thunderstorms' rains. Port Moresby registers the minimum rainfall for all recording stations in Papua, apparently on account of its being situated well away from the mountains on a small peninsula where the prevailing winds precipitate rarely.

The physical features of New Guinea being so varied account for the diverse annual rainfall averages. It is recognized that the coastal indentations, direction and height of the mountains, &c., deflect the rain-carrying winds, so that in some islands the wet season is experienced with the north-west winds blowing on one side of the island, whereas the south-east season is the wet season on the other side of the island which often is only a relatively short distance away.

TABLE No. 2.—YEARLY RAINFALL AND AVERAGES.

TERRITORY OF NEW GUINEA.

Locality.	1928.	1929.	1930.	1931.	1932.	1933.	1934.	1935.
Sepik District—								
Aitape	*100.54*	120.80	99.82	98.54	97.17	122.94	102.30	*86.97*
Madang District—								
Madang	148.16	141.06	141.36	113.57	117.79	148.44	101.14	153.28
Morobe—								
Salamaua	..	..	..	..	..	..	..	..
Lae	216.65	210.95	..	..	..	..	..	..
New Britain—								
Gasmata	234.34	313.76	133.99	246.29	279.98	171.93	189.56	269.56
Keravat	..	..	92.52	95.57	101.87	99.38	110.63	117.96
Kokopo	59.85	127.74	152.15	92.50	66.81	67.66	58.01	76.14
Notre Mal ..	..	153.74	152.48	158.70	157.74	141.27	132.55	*140.60*
Pondo	170.09	285.24	124.24	*117.25*	193.07	174.65	118.63	159.16
Rabaul	72.50	109.75	89.97	58.01	104.42	83.49	81.18	108.52
Talasea	159.62	233.33	*171.57*	148.53	179.48	176.07	112.88	165.25
New Ireland—								
Kalili	191.26	214.14	178.65	222.10	252.61	132.83	110.80	242.10
Kavieng	*103.26*	191.60	119.03	124.97	108.42	92.68	96.38	99.62
Namatanai ..	128.85	214.91	192.33	163.55	176.49	154.99	108.85	168.42
Kieta—								
Kieta	146.95	95.75	99.18	124.63	99.97	132.48	117.81	78.74
Rugen	..	..	..	..	94.27	108.99	100.81	95.08
Manus—								
Lorengau	..	168.38	162.56	163.39	187.11	126.65	155.08	122.75

Locality.	1936.	1937.	1938.	1939.	1940.	Years Recorded.	Yearly Average.
Sepik District—							
Aitape	86.85	110.12	90.86	123.36	104.11	20	99.65
Madang District—							
Madang	154.02	119.16	162.65	..	135.83	24	136.97
Morobe—							
Salamaua	..	187.55	157.80	147.24	159.52	4	163.03
Lae	..	..	163.09	163.30	173.96	5	185.59
New Britain—							
Gasmata	*220.33*	267.73	172.98	191.22	224.33	21	238.10
Keravat	125.72	103.29	76.25	124.64	103.28	11	105.56
Kokopo	84.37	65.41	56.55	86.90	69.87	14	80.51
Notre Mal	168.02	158.07	159.85	136.66	167.25	121	161.62
Pondo	191.86	199.93	141.81	147.39	160.44	15	170.64
Rabaul	109.79	98.90	72.52	82.07	77.57	27	87.31
Talasea	154.46	200.40	152.65	138.48	125.84	21	166.81
New Ireland—							
Kalili	186.72	227.18	123.17	189.12	*126.57*	17	185.91
Kavieng	162.22	116.04	119.47	155.73	103.28	24	121.10
Namatanai	142.59	143.43	143.23	144.44	135.57	23	141.76
Kieta—							
Kieta	93.08	95.72	98.45	101.50	109.63	24	116.74
Rugen	113.34	..	..	..	..	5	102.47
Manus—							
Lorengau	160.94	143.19	129.21	184.43	..	22	152.80

Records in italics are incomplete.

The south-east trade winds prevail throughout the Territories roughly from May to November. These winds continue with marked regularity until about October or November, when the north-west monsoon begins to assert itself in the

upper layers. The change in seasons usually covers a period of about six weeks in April–May and November–December, respectively. The north-west monsoon commencing about December is of a more intermittent character than the south-east trade wind and blows with more sudden squalls, generally bringing more rain, except in the more exposed islands where the rainfall is more regular throughout the year.

Both the seasonal winds carry moisture, but the degree of precipitation which occurs is regulated by the altitude and situation of the land areas which they strike *en route*.

In addition to the mainland ranges mentioned, high mountain ranges are found in the outlying larger islands of the Mandated Territory. In New Britain, New Ireland and Bougainville Island there are central backbones of mountains forming a distinct divide. On the western side of these barriers, the north-west season is the wet period while on the eastern side the dry season prevails. The exact opposite occurs in the south-east season.

Reference to Table 2 will show that there are no low rainfall belts in the Mandated Territory comparable with that at Port Moresby, the nearest approach being at Bulolo and Marienberg. The annual rainfall averages range from 55 inches at Bulolo in the Morobe District to as high as 277 inches at Ring Ring, on the south coast of New Britain. The rainfall on the coastal areas of this Territory are generally comparable with those in Papua. The greater proportion of the Territory is within the 100-in. to 200-in. isohyet and one large area on the south coast of New Britain comes within the 200-in. to 250-in. isohyet, and this is probably the wettest area in either Territory. It might be pointed out, however, that the largest area within the 200-in. isohyet is around the Delta Zone in Papua. There is generally a heavier distribution of rainfall in New Guinea than in Papua.

Topography, Geology and Soils: New Guinea.

The mainland of New Guinea is very mountainous; the central range rising to about 14,000 feet in Papua, and, approximately, 15,000 feet at Mount Wilson in the Bismarck Range of the Mandated Territory. The highest mountain is Mount Queen Wilhelmina in Dutch New Guinea, which is over 17,000 feet high and extends practically to the snow-line.

The average distance between the shore and the mountains ranges from about 10 to 60 miles, if the banks of rivers and deltaic areas are excepted, although in some places the country is mountainous right to the sea-coast.

The outlying islands are very varied in structure, the coral islands are usually flat and devoid of topographical features, but most of the larger islands are mountainous in the centres.

New Britain, New Ireland and Bougainville Island each have a central backbone of mountains. In New Britain there are several high peaks, the highest being Mount Ulawun (The Father, 7,546 feet) and Mount Bamus. In New Ireland, some peaks rise to almost the same height and near Kieta, Bougainville Island, is Mount Balbi (10,172 feet).

The New Guinea mainland, which was apparently attached to the Australian continent at one stage, is now only separated from it by the narrow Torres Strait.

The main central ranges of New Guinea run almost at right angles to the Great Australian Divide and the whole island is situated on the great submarine shelf which links up many of the South Sea Islands.

The geological and ecological conditions are much the same on the mainland of New Guinea, whether it be in the Dutch New Guinea, Papua or the Mandated Territory side. It would appear, however, from reconnaissance surveys that larger areas of older rocks are more generally exposed in Dutch New Guinea than on the British end of the island. Geological investigations have shown that very old rocks exist in Central New Guinea and Papua (of probably pre-Cambrian age).

Through the courtesy of Dr. Whyte, the author when visiting Java in 1934 saw 25 soil types, collected from Dutch New Guinea. Some of these were very old, reddish and very laterized soils, derived from granites, andesites, shales and sandstone formations. There are old Jurassic and the more recent Tertiary formations present.

It seems that volcanic action had almost finished in the Tertiary period in Dutch New Guinea as was the case in Australia where the main basalt formations also belong to this period. The alluvium derived from andesites (especially) and granites represent quite good soils which occur in patches up to 30,000 acres in extent. In the higher regions of the Dutch Territory there are large limestone massifs which yield reddish residual soils; in some areas sandy quartzite soils are said to exist.

In the Bismarck Archipelago and Bougainville Island, the oldest foundation rocks are mostly of secondary origin though in the Bainings Mountains and central ranges some older rocks appear. A great proportion of the formations in these islands which are apparent at the surface are recent to very recent in age, especially where volcanic action has continued right to the present time.

It should be noted that the oldest exposed rocks in Java are of old Tertiary and Quaternary formations which are geologically recent compared with older formations mentioned from New Guinea. Very recent volcanic soils are plentiful in Java and this fact largely accounts for the fertility of the soils and development of agriculture there.

Malaya, on the other hand, has large areas suited to rubber-growing because of the widespread and long-continued erosion from the hills and the extensive alluvial deposition on to the lower areas which has taken place in geologic time.

The stratification of the chief geological formations found in Papua and their sequence was listed as early as 1905.(2) Among the more recent rocks are grits, sandstones and conglomerates of Quaternary age. Greenish sandy shales, limestones and silicious beds of Tertiary age are present, e.g., the Port Moresby beds. Greyish, blue and green limestone of Cretaceous age are found, such as the Boioro limestone and the Purari River beds.

The Strickland River indurated calcareous shales are said to be of Jurassic origin, and these rest on old limestones of Devonian age. Earlier formations are crystalline schists and other metamorphic rocks. Limestones are developed to a very great extent in the Papuan deposits and are present as large barrier cliffs at the edges of the Central Plateau.

In some areas these limestones rest on schists (metamorphized) and in other areas on igneous rocks.

Recent volcanic activity and younger soil formations are much more widespread in the larger islands of the Mandated Territory than anywhere in Papua where such areas are of relatively limited extent. In some of the islands of the Mandated Territory, limited volcanic activity has continued right down to the

present time and, in these areas, the richest soils are found. Generally speaking, the most fertile soils in this Territory are in proximity to active or semi-active volcanoes, e.g., on the Witu or French Islands, Talasea, District of New Britain, Kar Kar or Dampier Island, Bougainville Island and the Gazelle Peninsula of New Britain, a large area of which was covered by the eruption of May, 1937.

In Papua, probably the only areas showing any comparatively recent volcanic activity are in some of the smaller islets, e.g., Goodenough Island.

In both Territories there are deltaic and estuarine deposits at the mouths of the main rivers and streams where mostly good agricultural country is to be found except in the swampy areas.

In Papua, several of their rubber plantations are situated on formations of this type, while similar areas were also selected for rubber by the German settlers in New Guinea.

There are large areas of coral islands and also raised coral rocks fringing the larger islands and Mainland of New Guinea. It is on the soils of these such areas that many coco-nut plantations are situated.

There are several reasons for stressing the relative ages of the rocks and the derived soils in these Territories. As a general rule in the tropics the fertility of the soils is inversely proportioned to the age. The loss of fertility with age is much greater and speedier than in the temperate zones, owing to the heavier rainfall and the excessive leaching of soluble chemical nutrients which occurs. This is to some extent alleviated where alluviation is on a large scale.

The importance of repeated volcanic activity in keeping up the fertility of such tropical countries as Java cannot be over-estimated. In the Mandated Territory by far the greater proportion of the plantation agriculture is found on the islands where the soils are geologically newer, though this is not the case in Papua.

Stanley[3] and several other geologists have dealt at length with the geology and other features of the Mandated Territory.

The former remarks that—

> Some of the rocks in the Territory decompose into rich, loamy soils, suitable for the growth of coco-nuts, cacao and rubber, &c., and it is important before taking up land for agricultural purposes to have the area tested. A soil survey will give the planter an idea of the type of crop to plant and indicate the possibilities of a particular area. Its importance becomes apparent when it is realized that soils vary considerably in any one district depending almost entirely upon the rocks from which they have been formed.
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> The rainfall and soil conditions in the Mandated Territory are ideal for the growth of rubber. It is unfortunate, however, that some of the rubber plantations here were raised near the coast line. Although the soil is so suitable, the rubber trees seldom do well when exposed to sea breezes. The ideal situation for the cultivation of rubber appears to be sheltered valleys away from oceanic influences in a soil rich in volcanic sediments and a little limestone.

A large proportion of the soils fringing the Mainland and the larger islands are of coral derivation as previously stated, and have often been raised by volcanic activity in the centre or tectonic earth movements. The coralitic soils usually merge into soils derived from volcanic rocks or from older geological formations, where the landward portions of the plantations run into the hilly country.

The soils next in importance are those derived from volcanic sand, pumice, tuffs, &c., all of which are very porous, and to a lesser extent from lava flows as at Talasea and Kar Kar Island. A few of the existing coco-nut plantations and

portions of a large number of them, some with rubber also planted, are on soils derived from other rocks, plutonic, metamorphic or sedimentary (e.g. syenite porphrys in Kieta, trachytic andesites, Gazelle Peninsula and porphyrites and salicified sedimentary rocks on the Bainings District of New Britain). Finally, there are the plantations situated on the estuarine deposits of the Mainland, already referred to and which, like the coral areas, are usually flat. Thus on the Mainland near the coast and on the courses of the three principal rivers, Sepik, Markham and Ramu, is more or less level country, but this only forms a relatively small fraction of the total area.

The question of transport by sea, lack of roads, the general ruggedness of the country, and the fact that many of the central areas are only under partial control has mainly confined the selection of plantation sites in both Territories to the sea coast and mostly to the best anchorages.

Almost the whole surface of New Guinea below the timber line is covered with an apparently impenetrable tangle of forest trees (rain-forest) and undergrowth matted and meshed with tropical vines. Usually in the virgin forest the undergrowth is not so dense as would be first thought.

There have been numerous references to the inland plateau near Mount Hagen and at the head of the Ramu River. This area has great prospects for other crops, but generally the altitude is too high for rubber culture.

General Economy.

The Territories of Papua and New Guinea are very similar in natural resources, population, physical characteristics and geographical conditions, &c.

The natives in general are of a similar type, although of course many different tribes and standards of intelligence are represented in the natives of both Territories.

There are quantitative differences as to population, labour, cultivated land, also deviations in economic development and policy. It is certain, however, that the general conditions in Papua more closely parallel those in the adjoining Mandated Territory than those of any other tropical country. It is for such reasons that the progress of the rubber industry there is of such particular interest to the survey in progress and is dealt with as fully as possible.

In Papua, the author has had only personal experience of the plantations around Sogeri on the Astrolabe Tablelands which is perhaps the biggest rubber district, and also with the general conditions at Samarai and Port Moresby.

The present Director of Agriculture and other officers in the New Guinea Department of Agriculture have had close contact with rubber planting in Papua, especially in the early stages of development, and the results of their experiences have been made use of. Reference has also been made to various articles and reports giving particulars of the rubber planting industry there.

Development of the Rubber Industry in Papua.

The first rubber exports from Papua from 1885 until about 1908 were derived from the indigenous tree *Ficus rigo*, and from indigenous rubber vines, which are discussed later.

Introduction of Para Rubber.

Messrs. Green and Garrioch introduced the first Para rubber plants into Papua.[4] On the 24th December, 1903, they planted 8 acres of *Hevea* rubber at Sogeri and the following year 5 acres. The Government also imported 100,000 seeds in October, 1906, but it was not until about three or four years later that a determined start was made with rubber planting. The derivation of these rubber seeds is not stated, but it is believed that they came from Malaya, to where they were introduced via Ceylon. In any case, they were derived from the same original stock as all other *Hevea brasiliensis* planted in the East and would be just as variable in the unselected state, containing the same percentage of high-yielding trees.

In 1907, according to Staniforth Smith,[5] there were ten Government nurseries in existence containing about 230,000 young *Hevea* rubber trees available for planters, at different places between the extreme west and the extreme east of the Territory.

Establishment of Government Plantations.

The policy of creating Government plantations was inaugurated by Sir William Macgregor from 1895 to 1898, when small areas were planted with coco-nuts at Rigo and Daugo Island in the Central Division, and at Samarai and Gasila Islands in the Eastern Division. Owing to the limited revenue available, little further progress was made until about 1910 when the Federal Government decided to grant the Territory of Papua a loan of £5,000 a year for five years for the purpose of developing Government plantations.

Three plantations were originally started with this grant: one adjoining the Government Experimental Station on the Kemp Welch River in the Central Division, where 277 acres of rubber were planted; the second at Orangerie Bay (1,000 acres of coco-nuts) and the third at Nare Island. The two latter plantations were situated in the Eastern Division and were intended for coco-nut plantations.

In addition to the above, small Government plantations or experimental stations of about 20 acres were established in the various districts, the main ones being at Milne Bay (sea level) and Hombron Bluff (1,800 feet).

The Hombron Bluff Experimental Station was started in a situation about 20 miles from Port Moresby, at an elevation of about 1,800 feet, and various types of rubber were amongst the plants tried out.

The original grant by the Commonwealth Government to the Territory for establishing the above-mentioned plantations was £5,000 per year for five years without interest. This amount was subsequently increased to a total of £27,500 and to this fund an additional £2,500 was contributed from Papuan revenue, bringing the total expenditure to £30,000.

In the 1927–28 Papuan Annual Report, it was indicated that the success of the Government plantations at Orangerie Bay and on the Kemp Welch River enabled the Papuan Government to pay off the Commonwealth loan in full. The last instalment was paid from the earnings of 1927–28 and the total repayments were made entirely out of plantation profits.

A small Government rubber station is established at Kokoda and, although it was apparently established in 1907, little mention of it is made in the annual reports. Clune[6] refers to this station, which has done very good work in proving the prospects for rubber in that district. The latest figures show that 8,886 trees yielded 88,584 lb. of dry rubber in the year ended 30th June, 1939. This averages practically 10 lb. per tree, equivalent to a return of £50 per acre with rubber at 1s. per lb.

The establishment of these Government rubber plantations was a very sound scheme, but in the light of present knowledge there are some weaknesses in the project as conducted now. It seems that formerly the plantation was mainly run commercially with the object of arriving at the suitability of the district, the costs of production and probable returns from the crop. It would also seem that the plantation was inconveniently placed, and the unit area was rather small to arrive at the lower costs of production possible. It does serve, however, to show what a small planter can do, under the particular conditions existent in Papua. In the past there has been apparently only a small amount of provision for experimentation and very little with the object of developing superior high-yielding planting material, which should now be one of the main objectives of such a Government-controlled plantation. Some work is now proceeding along the lines of seed selection, but more than this is required.

At the several Government rubber plantations in Java and at Sungei Bulch Plantation attached to the Rubber Research Institute, Malaya, it is found possible to carry out extensive rubber improvement work, and at the same time make the plantations pay.

It is reasonably certain that similar work will be carried on at the newly opened up rubber plantations at Ransiki River, in Dutch New Guinea, where they are starting with the best clones* available. The increased yields which would accrue from rubber trees developed to yield three or four times as much as the normal yields in Papua would quickly pay for the work involved and would be of great value to the country generally.

Kemp Welch Government Rubber Plantation.

Kemp Welch Plantation is a source of revenue to the Government and no doubt fulfils a most useful purpose. It has apparently been a successful venture and has served as an efficient demonstration of the possibilities of rubber growing in Papua.

The precaution was taken to grub out all stumps and roots before planting which greatly lessened the danger from fungoid root diseases, though it may have proved rather costly. This plantation is comprised of 277 acres, of which 230 acres contained 10,600 tappable trees according to the 1925-26 Annual Report, and 47 acres with about 2,250 younger trees, of which a considerable proportion were approaching the tapping stage. (At the present time these are mature trees.)

In the 1938-39 Report[7] there is reference to a new area of 40 acres which was cleared and ready to plant by December of that year, which brings the total to 317 acres. It was stated that, other than a small increase in the labour force, very little additional expense would be entailed when this new area reached the tappable stage. It is understood that this new area was planted up from selected seed.

* A "clone" is any number of individual trees derived by vegetative propagation from one original selected mother-tree.

In the 1937-38 Report[8] the manager reported that he had over 1,000 plants in the nursery derived from seed which had been obtained from the Koitaki Rubber Estates. This seed was probably harvested from a selected area of rubber which will be referred to under the heading of seed selection. There were also some 3,500 plants grown from local seeds (it is not stated whether these were from selected trees) in the nurseries, all of which were doing well.

In 1926, there were 30 native tappers employed, each with a task of 350 trees to tap every day, except Sunday. In August and September of that year, the trees were "wintering" and the yield fell off somewhat. The average monthly output of dry rubber was 5,251 lb., which, for the full year, gave a yield of 28 tons 2½ cwt. for the 10,600 trees tapped, or an annual yield of approximately 6 lb. per tree. The plantation showed a net profit of £4,006 13s. 6d., or over 7s. 6d. per tree for that year.

In the 1930-31 Report[9] it was stated that the estimated loss for the year was £1,043 10s., chiefly owing to the very low prices of rubber prevailing, namely, rubber was at 4d. per lb. in 1929-30, and fell to 2⅜d. per lb. at one period.

The position would have been much worse if the Commonwealth Government had not imposed a duty of 4d. per lb. on all rubber except that coming from the Territories.

The yearly average rainfall at Kemp Welch was 63 inches, but in 1930 only 31.96 inches were recorded and this reduced the yield from 19¾ to 14¾ tons.

In 1935-36, the yield was about 447 lb. of dry rubber per acre, and in 1936-37, 63,626 lb. was harvested, or approximately 454 lb. per acre, while in 1937-38, the yield increased to 64,334 lb., or almost 460 lb. per acre. The actual net profit for this latter year amounted to £898, which was the lowest figure since the year 1933-34, and the drop was attributed to the fall in the price of rubber. Another factor in the drop in profit was because of the 2d. per lb. assistance which was received for the four years preceding 1937-38 not being paid.

According to the manager, another record was established in production figures for the estate, some 66,653 lb. dry weight of rubber sheet being produced in the plantation, 88 per cent. of which was of the highest grade. The manager was of the opinion that this figure will be exceeded in 1940 without over-tapping.

The plantation produced a net profit for the year of £866, despite the fact that over £273 was paid to a relieving manager.

Costs of production on this plantation will be dealt with under that heading.

In 1936-37, it was found that many of the trees were suffering from "die-back" associated with the rather weakly parasitic *Diplodia* fungus. The conditions associated with this disease at Kemp Welch are not accurately known. The most typical form of "die-back" is found, however, on steeply sloping hilly areas which have suffered badly from erosion or on areas which have been neglected in some way. Rubber trees growing for some years also tend to exhaust the soil and this may lead to reduced vigour and consequent "die-back". The reduction of leaf canopy due to any cause leaves the branches open to sun scald and heating of bared branches, with later infection by the "die-back" fungus.

In the Papuan Annual Report, 1937-38,[10] it was stated that "the plantation again looked well," and that "the 'die-back' disease is practically under control," while the manager was hopeful that he would eradicate the whole lot of it by the

following year. Judging by the annual yield increases, this condition had not been so serious as was formerly thought, and the returns from new planting are probably more than balancing the loss in production from affected areas.

Native Rubber Plantations: Papua.

According to Annual Reports of Papua,[11] particularly those of 1920-21 and 1927-28, there were sporadic attempts to develop planting of rubber by natives in Papua. In 1920, it was recorded by the Assistant Resident Magistrate of the Kokoda District that 7,169 rubber trees were planted in 27 villages at the same time as 4,523 coco-nut palms were planted in 25 villages, which, in 1921, were then over five years old.

The natives were also encouraged to plant lime trees (as they could be taught to tap their rubber trees). The idea was to coagulate their latex with lime juice so they could manufacture and smoke a fair grade of rubber for market. It was also remarked that no native rubber was tapped in 1921-22 owing to low rubber prices.

Rubber Plantings at Government Stations.

In the 1927-28 Annual Report,[12] the following information is given regarding rubber planting at Kerema Station in the Gulf Division. "The whole of the available land adjoining the station has now been planted with rubber, 4,171 trees in all, or approximately 39½ acres; 850 trees of this area were then being tapped." The present Director of this Department was associated with this work in the first instance.

Two hundred acres of hilly land were purchased about 2 miles from the station on the Cupola-road. This area is gradually being cleared by local natives under contract. Two villages started to work during the year and then gave up. Others have taken their place and carried on and at the close of the year there were three villages working about three blocks of about 100 acres in all, most of which has been felled, while approximately 45 acres in the three blocks were burnt off and garden produce planted. This at the time is being lined up and holes dug for rubber planting.

In the Delta Division, the Station Rubber Plantation had also been established and yielded 6,602 lb. of rubber in 1927, of which 5,730 lb. comprised dry rubber and 872 lb. scrap rubber, exceeding the previous year's figures by 521 lb.

Apparently, these native and station rubber areas have not been continuously tapped; nevertheless, they are still in existence and, according to the Director of Agriculture here, the healthy condition of the trees in the Gulf and Delta Divisions led to larger areas of land being recently alienated there for the extension of planting while rubber is at payable prices.

Exploitation of Native Rubber in Papua.

In the early days, e.g., from 1885 to 1912, of the rubber industry, exploitation in this country largely consisted of rubber derived from the indigenous tree *Ficus rigo*. It is believed that only very small quantities of this indigenous rubber have been exported since that time, and only when prices were extremely favorable.

Indigenous Tree-rubber, *Ficus Rigo*.

According to Staniforth Smith,[13] the chief rubber-yielding plants indigenous to Papua are *Ficus rigo,* Bailey, and a species of vine the identity of which has not been definitely determined. *Ficus rigo* is a tree which is found chiefly in the Rigo District, where it is known to the natives as "Maki". It furnishes rubber of good quality, which has been collected by the natives for export. Before the war, small-scale experimental plantations of these trees were planted in Papua. About 1912, specimens of the *Ficus* and vine rubber from Papua were sent to the Imperial Institute for examination.

Sample No. 1.—Indigenous tree-rubber, *F. rigo,* from Central Division.—Irregular lumps of rubber, which were slightly sticky externally in places. The rubber was clean and varied in colour from light to dark brown; it exhibited good elasticity and tenacity.

Results of Analyses.

	Per cent.
Loss on washing (moisture and impurities)	3.6
Composition of dry rubber—	
Caoutchouc	91.1
Resin	4.9
Protein	3.1
Ash	0.9

It was valued at about three-quarters the value of fine hard Para rubber at that time.

The sample was very satisfactory in chemical composition and in physical properties, and, if free from stickiness, the rubber would realize a higher price than was quoted.

Sample No. 2—*Vine Rubber.*—This sample contained a considerable amount of impurity, and was sticky externally. The percentage of caoutchouc in the dry-washed rubber was 86.8 per cent. and the percentage of resins, 11.1 per cent., was rather too high.

Rubber of similar composition but well prepared would not bring much less than the *Ficus* in price. Formerly, it was necessary to have a licence to collect bush rubber in Papua except on owners' holdings, and it is believed that this provision is still in force.

Rubber is one of the approved plants listed by the Government to comply with the planting conditions set out for agricultural leases under the Lands Ordinance.

Establishment of Rubber Planting by Companies and Individual Planters.

It would appear that rubber planting in Papua on a commercial scale commenced in 1906, about the time the British New Guinea Company was formed, but had not made much progress until 1910. This company, which is still in existence, was heavily capitalized when it came into existence with a nominal capital exceeding £1,000,000. It was a trading and shipping concern and had varied planting interests, much the same as the German New Guinea Company had in the Territory of New Guinea and Burns Philp and Steamship Trading Company have in Papua to-day. A great proportion of shareholders were small investors living in England. This company is the largest of the pioneer companies which commenced rubber planting in Papua. A combination of circumstances

such as over-capitalization, early mismanagement, and other factors later caused them to sell out some of their interests. Papua must be greatly indebted to the early initiative and continued progress of this company, particularly in rubber and coco-nut planting. Despite many setbacks, especially when prices for their products sank to ruinous levels, they have carried on and for several years under capable management and direction have paid substantial dividends, on a somewhat lower capitalization.

The author has not a complete list of the rubber companies operating in Papua nor particulars of the early development of some of these estates. Of rubber-planting companies which started around 1910, a few have gone into liquidation and others have sold their interests to other concerns. Further, several of the plantations devoted to rubber are also growing coco-nuts and other crops, also some companies and individuals who intended to plant rubber when prices were high in the early boom period were influenced by the low prices prevailing in the years 1921-22 or for other reasons turned their attention to coco-nuts.

The British New Guinea Company has been mentioned, but there were several other enterprising companies and individuals associated with the early development of rubber growing in Papua. As already pointed out, the Government and officials showed initiative in supporting their enterprise at the commencement.

At Sogeri, Koitaki Rubber Plantations Limited is one of the most progressive concerns in Papua, and is under capable management, which has been associated with this large plantation practically since its inception. Much can also be said for the initiative of private planters, such as G. H. Loudon, who has developed a very fine rubber plantation, Eilogo, at Sogeri, and paid for much of the cost of bringing into bearing with good-quality interplanted coffee. This coffee has also proved a useful revenue producer when rubber prices were low.

In a 1916 Report on British and Australian Trade in the South Pacific[14], the evidence of the representatives of two Papuan rubber-planting companies is included. The plantation of the Milne Bay Rubber Proprietary Limited is situated at Milne Bay, about 30 miles from Samarai in Papua. The following particulars were given:—

The total area of the property is 10,000 acres, of which 1,750 acres were cleared by 1916, 1,421 acres being planted to coco-nuts and 135 acres planted to rubber. The planting was commenced with rubber in 1910, and in October, 1916, the trees planted in 1911 were five and a half years old and just arriving at the tapping stage. (These trees would now be 30 years old.) The company commenced at first with rubber planting, but later went in for coco-nuts as indicated. The rubber pests, rats and wild pigs were rather serious and caused a great deal of trouble by destroying the young rubber plants.

Planting was being continued, but the pace of planting slackened as the area increased as the bulk of the labour was engaged in keeping down weeds and in conserving the planted area.

It was also stated that amongst the most obstinate pests was Lalang or Bladey Grass, *Imperata arundinacea,* which costs £2 to £3 per acre to keep down (this pest can now be kept down by proper cover-cropping and management), and the presence of root fungi was also referred to.

As to communications, a government road runs from the sea frontage of Milne Bay through the plantation to the properties beyond, and the seaport Samarai is 30 miles away by launch.

Domara River Plantation[15] is on the south-east coast of Papua, near Abau, half-way between Samarai and Port Moresby, the total area of the lease being 2,500 acres, and in 1916 the planted area was something over 700 acres, consisting of rubber trees and coco-nut palms and in addition to copra driers a rubber factory was built. It was estimated that the cost of bringing the rubber into bearing on this property was £30 to £35 per acre, and that before putting in the rubber trees a cover crop has to be put in to keep down the undergrowth if this estimate is to be realized.

Abau Plantation mentioned above was privately owned and only partially planted with rubber.

There are some individual rubber planters on a small scale in Papua, who also combine coco-nut growing and trading amongst their diversified interests. Their factory equipment and plantation buildings are must less elaborate than those of the larger companies, and still they manage to turn out a high-grade marketable product.

Some other rubber companies which are operating or have grown rubber in Papua are as follows:—

Kuala Selangor, on the Robinson River.
Mullin's Harbour Plantations Limited, on Mullin's Harbour.
Papuan Products Company Limited, a New Zealand company, apparently now partly taken over by another newly formed company.

Later Development.

In the *Pacific Islands Monthly*, 23rd March, 1937, there are particulars of some intended extensions of rubber planting in Papua—

With the object of planting rubber on an extensive scale in the Kanosia District, Mariboi (Papua) Rubber Estates was incorporated under the Papua Companies Ordinance on the 15th February with a nominal capital of £50,000, in shares of £1 each. Steamship Trading Company are interested in the enterprise.

The company, it is understood, will take over a considerable area of land from Tropical Products Proprietary Limited, incorporated in January. The latter recently acquired 9,000 acres at Kanosia for planting rubber and other tropical products.

Kanosia is a well-known and tested rubber district in Papua, within easy reach of the seaboard.

The district mentioned is situated in the Central Division, approximately opposite Yule Island, where a decidedly greater rainfall is experienced than in the dry zone around Port Moresby itself.

Another rubber-growing district which has come to the fore is at "Kokoda", in the Northern Division of Papua, which is on the Mandated Territory side of the Owen Stanley Range and almost adjoining the Morobe District. This area must be on almost the same type of geological formation as exists in the latter district.

There are no roads to this area and the freighting of supplies and prepared rubber is by aeroplane, as these interior mountains have apparently proved impassable for roads. When flying from Port Moresby to Kokoda, the Central Range has to be passed over at 12,000 feet, with Mount Victoria (14,000 feet) lying just to the west. The plantations are situated in the Yodda Valley to Ioma (pronounced "Yoma"). Clune[16] describes a recent visit to Kokoda and Lolorua Plantations in very interesting and popular style, and gives a good idea of the difficulties surmounted in establishing rubber growing in this area.

It seems that in this district there is an abundant supply of labour of the Orakaiva tribe, who are anxious to work. Lolorua Plantation has an area of 1,250 acres, containing 50,000 trees in tapping and another 50,000 trees planted, and the manager said that "the average yield is approximately 7 lb. of dry rubber per tree per year, or 700 lb. per acre.".

The climate and soil conditions are ideally suited to rubber and the elevation of about 1,000 feet is also optimum for rubber as is shown by the girth development and latex yield of the trees.

The "Sacred Heart Mission" intends to plant rubber at Sagarai Valley District in the Eastern Division; other areas are also being cleared in this vicinity and made ready for planting. This area is close to Milne Bay.

At Kikori in the Delta Division, another area suited to rubber-growing is found. The plantations here, situated on the banks of the Kikori River, have an average annual rainfall of over 230 inches.

The Plantation Industry in Papua.

Transport Difficulties.

The companies and individual planters who commenced and founded the rubber industry in Papua are to be commended. This was carried out in the face of many difficulties including the teaching of Papuan labour how to tap the rubber trees and carry out factory operations, &c.

The transport facilities were decidedly lacking and this was especially so in the case of those plantations situated in the Sogeri District on the Astrolabe Tableland.

Dr. Klein visited Papua and New Guinea as a member of the Dutch Colonial Institute and in a later report[17] made the following comments:—

> Rubber is doing well in Papua and, although it is the only commodity that private enterprise would at present, like to start on the Dutch side, the international rubber restriction (at that time) prevents us from doing so. Looking at the absence of restriction in Papua, one wonders why they did not increase more quickly and then the lack of a road leading to the best rubber district (Sogeri) seems to me (i.e. Dr. Klein) to explain this.

In the early days when Itikinumu, Koitakinumu and other plantations were established at Sogeri, the machinery, stores, &c., were all brought in by native carriers, the costs were high and there was little chance of replacement if any breakages occurred.

At the present time there are about 3 miles of road on a relatively steep mountain pass scouting the Rona Falls, where mule trains are employed to carry the processed rubber and coffee over the pass and out to a motor road which ends at Rona Falls. On the return journey, the stores are brought back to the plantation (or a depot to be later picked up by motor lorry).

It was only in 1928 that a start was made by the Koitaki Company and the British New Guinea Development Company Limited, with the assistance of a grant of money from the Government to construct a motor road from the latter company's "Itikinumu" estate through "Koitakinumu", to within a distance of 3 miles of Rona Falls. This is the road on the Sogeri side of the Falls, which extends a distance of 7½ miles still leaving the 3 miles of uncompleted road, where the mule trains are used at the present time to link up with the 21 miles of motor road leading to Port Moresby.

It would seem that over the years the money involved in putting in those 3 miles of road would have been returned over and over, or, at least the interest on the money, would have been.

In July, 1936, an effort was made by some of the members of the Papuan Legislative Council to induce the Papuan Government to ask for a grant, or loan, from the Commonwealth of up to £15,000 to enable them to complete the road from Rona Falls onward for motor traffic and to erect a high-level bridge over the Laloki River. It seemed that little further was done in the matter until recently when £5,000 was granted for the purpose but there may have been some good reasons for this. It was urged by the planters that the completion of this road would be an inducement to investment in this district, where thousands of acres are said to exist which are ideal for rubber, coffee and possibly tea. If the 3 miles of road were completed, this would do away with the pack-animals as used over the past 28 years to and from the Sogeri District.

Apparently, the Government sent District officials to look over the district where the planters contended that extensive rubber areas existed, and the report was unfavorable. See *Pacific Islands Monthly*[18] where the following heading occurs:—

No More Land Available at Sogeri, Papua.

At the request of the planting interests, the Government has recently investigated the possibilities of the Sogeri District for further development. Three officers of the service made an extensive survey of the district and the hinterland beyond.

From their reports it appears that the area of land believed to be available for settlement has been exaggerated, and that there is very little suitable for development beyond two comparatively small areas used by the natives for their hunting grounds. Beyond these areas the country is rocky and precipitous, in some parts rising to a high wall of rock over which extend further rocky ranges.

Thus it would appear that further extension of development in the district is impracticable.

It would appear that such a survey, as with any other economic survey conducted in either this Territory of Papua, requires a soil survey conducted by a soil chemist; also a careful review of the possibilities by a qualified rubber man. A survey under other circumstances may or may not be correct.

If large additional areas suited to rubber planting do exist in that district, there seems to be little doubt that only lack of enterprise would preclude the provision of better transport facilities. The cost of transport adds to the cost of production and this is one reason why rubber costs there are higher than in Malaya.

Papua: Area under Cultivation and in Tapping.

Such complete particulars of the areas under rubber cultivation in Papua for the various years as for tonnage and value of rubber exported are not available in this Department. It is possible, however, to trace the trend of developing the industry from the figures on hand.

Up to about 1906 very little *Hevea* rubber had been planted in Papua and it was not until the years 1909-10 that any noticeable area was planted. The total area under cultivation for all crops in Papua, in 1907, was only 1,067 acres and this area was probably mainly coco-nuts.

By 1908 the total area had been quadrupled to 4,955 acres, of which a fair proportion was probably under rubber; 3,808 acres of rubber out of a total of 7,740 acres (or nearly 50 per cent. of the total acreage) had been planted by 1909-10.

It might be pointed out that 3,808 acres represents practically a quarter of the area under rubber in 1939-40.

By 1912-13 the total area under cultivation had increased to over 35,000 acres of which 6,275 acres (equal to 19 per cent.) were under rubber. This corresponded to about half the 12,964 acres of rubber planted up to 1939-40, i.e. 27 years later.

TABLE No. 3.—AREAS UNDER CULTIVATION IN PAPUA.

Year.	Total Areas Planted.	Area taken up for cultivation of Rubber.	Area taken up for cultivation of Coco-nuts.
1907	1,467	*	*
1908	4,955	1,698	5,365
1909	7,740	1,886	6,716
1910	10,053	2,889	9,513
1911	15,881	4,496	15,993
1912	24,707	6,256	21,958
1913	35,303	6,606	29,030
1914	42,921	6,203	32,722
1915	44,447	7,671	34,016
1916	44,959	7,760	34,686
1917	47,319	8,311	42,675
1918	57,593	8,598	43,560
1919	58,347	8,363	46,101
1920	62,162	7,250	44,328
1921	60,314	7,465	46,515
1922	60,044	7,171	46,360
1923	60,863	7,481	46,797
1924	61,180	7,846	48,022
1925	62,981.	7,728	50,506
1926	63,000†	7,981	50,218
1927	61,370	8,212	49,244
1929	60,136	8,804	48,363
1929	59,487	9,012	49,072
1930	58,904¼	9,075½	47,838
1931	61,219	10,320	49,413
1932	59,751	8,796	49,305
1933	58,244¼	8,993	47,921
1934	59,445	8,933	49,032
1935	58,628	9,591	47,641
1936	59,945	10,270	48,188
1937	57,636	11,836	45,207
1938	59,945	12,809	44,188
1939	..	12,964‡	..

* No record.
† Approximately.
‡ Actual area under cultivation, according to latest Annual Report of Department of Agriculture, Papua.

N.B.—There are practically no records of the actual area under cultivation for rubber and coco-nuts in Papua. The figures presented in the Papuan Annual Reports represent areas actually taken up for cultivation of such crops as given in the above Table.

The acreage of rubber remained relatively stable, around 7,250 acres, from 1919 to about 1928-29, when it was increased to 8,804 acres, and again to 9,012 acres in 1930-31, and by 1935-36 another 500 acres had been added, thus bringing the area under rubber to 9,591 acres. Since that time, a fairly rapid development has occurred, about 3,353 acres being added to this total in the four years ending 1939-40, and the development is still continuing. This position should be compared with the acreage planted between 1912-13 and 1934-35, when in the previous 22 years the acreage increased from 6,275 to 9,591 acres—an increase of 3,216 acres.

Reference to Table No. 3 will show that the total area under cultivation in Papua for all crops has increased very little since 1919 (58,347 acres then, compared with 59,945 in 1938). The same applies to the area under coco-nuts, which has tended to decrease, if the figures given are correct, probably due to old areas being abandoned.

Reference to Table No. 4 gives particulars of rubber-producing districts in Papua. This table shows that the main rubber-producing districts are in the Central and Eastern Divisions. The Central Division, with Port Moresby as the shipping centre, contains easily the most important rubber-growing areas in Papua, as five-sixths of the whole planted area (10,121 acres) are in this division. In the next important area, the Eastern Division, with Samarai as centre, 852 acres are planted, while the Delta and Northern Divisions rank next with 690 and 542 respectively under rubber cultivation. There are also relatively small areas in the Western and Gulf Divisions. No rubber is planted in the South-eastern Division, which includes the Louisiade Archipelago and other islands, or North-eastern Division adjoining Morobe. It would seem from the areas recently taken up for rubber-planting that more extensive planting is now being carried out in the coastal districts and more attention being paid to the Northern Division.

The western part of Papua for 300 miles along the coast is generally low and swampy, mangroves and sago-palm being prominent features of these swamps. The delta country of the Fly and Purari Rivers are represented in this area.

TABLE No. 4.—RUBBER PLANTATION STATISTICS—PAPUA.
ACREAGE IN VARIOUS DISTRICTS.

Division.	Year.					
	1925.	1927.	1930.	1933.	1937.	1938.
Central	6,089	6,350	7,329	6,814	7,966	10,121
Eastern	868	889	880½	804	944	852
Delta	445	605	449	625	629	692
Gulf	15	42	131	268	268	268
North Eastern (adjoining Morobe) ..	..	..	..	..	..	..
Northern	165	165	125	153	133	542
South Eastern (Louisiade Archipelago)	..	..	..	..	..	..
Western	146	161	161	329	300	334
Total	7,728	8,212	9,075½	8,993	10,240	12,809

N.B.—These Statistics may represent areas taken up only; they appear somewhat unreliable.

Acreage of Rubber Planted in Various Districts.

Table No. 4 shows the relative development of rubber-planting in the various districts by comparing the years 1925, 1927, 1933, 1937 and 1938. It will be seen that the greatest development of rubber-planting is in the Central Division, where 10,121 acres of rubber were planted by 1938, and this represents an increase of 4,000 acres since 1925.

The position in the Eastern Division, where the next largest area is planted, appears to have altered very little in that time.

In the Delta Division there has been an increase of about 250 acres since 1925, while in the Gulf Division there has also been a similar average increase on a much smaller total, namely, from 15 acres to 268 acres, and this is likely to increase further.

In the Northern Division there was no increase in planting until quite recently, when 400 acres of rubber were added between 1933 and 1938, apparently around Kokoda. This Division now has twice as much under rubber as the Gulf Division, whereas five years ago the position was reversed.

The Western Division showed an acreage increase of almost 300 acres between 1925 and 1933; since that time, there has been practically no development, unless it occurred very recently, or in the South-eastern Division, which includes the Louisiade Archipelago and other islands.

TABLE No. 5.—PAPUA—PARTICULARS OF AREAS PLANTED.

—	1938–39.		1939–40.	
	Acres.		Acres.	
Area under lease for rubber growing	77,411		..	
Area being tapped	7,224		7,904	
Area being planted, not yet tapped	5,585		5,060	
Area planted	12,809	14,433	12,964	14,494
Area cleared	1,624		1,530	
Area undeveloped	62,978		..	
Total	77,411		..	

The calculations for the area being tapped were made as follows:—The rubber production for the year was 1,290 tons. Assuming the average production per acre per annum to be 400 lb., the area being tapped is estimated to be approximately 7,224 acres. The statistical position of the rubber plantings was thus stated as given.

In the Annual Report of the Department of Agriculture, 1939-40, the following particulars are given. During the month of May, 1940, an opportunity was taken to circularize planters for the purpose of ascertaining the position of the rubber industry in the Territory, details of which are as follows:—

TABLE No. 6.—AREAS OF RUBBER—PAPUA.

Number of producing plantations	23
Total area cleared for rubber cultivation	14,494 acres
Area planted with rubber	12,964 acres
Area being tapped	7,904 acres
Area not at tapping stage	5,060 acres

The annual production of the tappable area is estimated at 3,009,379 lb. (rubber exports—1,345¾ tons).

Yield Per Acre—Papua.

Taking the above figures as a guide, the average yield per acre is 380 lb.; but, according to the Director of Agriculture, Papua, this figure is rather misleading, as some plantations produce as much as 500 to 520 lb. per acre, whilst

in an isolated instance the yield was given as 1,428 lb. This latter yield may appear somewhat fantastic. It would seem that the explanation is that the trees on this particular area are very old and have not been tapped for many years (also probably tapped very heavily).

Land and Surveys.

During the year, applications were received for 23,239 acres of land, of which 21,814 acres were granted; of these, 21,603 acres were for rubber, and only 111 acres for coco-nuts. The low price of copra has had the natural effect of discouraging investment in coco-nut plantations in Papua, and the more favorable prospects for rubber have had the effect of diverting the attention of investors to this culture.

The total area of land now held under lease for the cultivation of rubber exceeds 70,000 acres (77,411 acres).

In 1936-37, there were nineteen applications for 29,120 acres of land for rubber-planting, of which 25,372 acres were granted.

TABLE No. 7.—PRIMARY PRODUCTS—EXPORTS FROM PAPUA, 1928-1939.

(Comparative Table.)

——		1927-28.	1928-29.	1929-30.	1930-31.	1931-32.	1932-33.
Copra	Tons	9,825	12,480	11,693	9,436	10,011	9,686
Value (Diminishing) ..	£	194,019	214,051	176,485	93,710	100,454	89,512
Desiccated coco-nut ..	Tons	108	261	747	1,467	1,228	1,118
Value	£	7,407	16,033	39,923	79,264	59,826	49,514
Rubber	Tons	811	470	764	785	806	953
Value (Rising)	£	102,158	46,816	50,640	47,036	49,262	56,929
Coffee Beans	Tons	..	4	5¾	2¾	8¼	36¼
Value	£	..	313	519	242	537	2,404
Cocoa Beans	Tons	2,660	784	..	..	..	..
Value	£	149	17	..	..	..	..
Tobacco	Tons	..	..	..	..	2,085	..
Value	£	..	..	..	..	216	..
Cotton	Tons	1	3.7	2	½	..	..
Value	£	59	415	167	28	..	..
Grain Pulse	Bushels	..	..	..	24	22	34
Value	£	..	..	..	956	782	1,379
Hemp	cwt.	..	..	1¼	135	..	..
Value	£	..	..	3	271	..	..
Timber ..	super. feet	13,783	2,105	183	396	4,689	9,163
Value	£	276	59	7	12	47	351
Bark—Mangrove ..	Tons	5½ (cwt)	..	..	..	..	10
Value	£	18	..	..	..	..	41
Gum	Tons	76	28	58	16	22	14
Value	£	1,955	593	1,377	519	532	274
Sandalwood	Tons	21	6	97½	28	91¾	25¼
Value	£	424	225	2,779	716	2,523	536
Gold	oz.	2,173	2,281	5,634	6,923	8,574	15,268
Value	£	6,364	6,767	10,632	22,440	34,338	45,383
Total Exports, Value*	£	350,363	337,365	342,775	274,354	269,354	275,866

* Includes other items—chiefly shell and minerals.

TABLE No. 7.—PRIMARY PRODUCTS—EXPORTS FROM PAPUA, 1928-1939—*continued.*

(Comparative Table.)

—		1933–34.	1934–35.	1935–36.	1936–37.	1937–38.	1938–39.
Copra	Tons	8,082	8,570	10,549	13,600½	11,249¼	9,357¼
Value (Diminishing) ..	£	42,990	57,597	100,681	191,808	91,166	57,999
Desiccated coco-nut ..	Tons	1,274	1,453	1,415	1,498¾	1,541¼	1,580½
Value	£	48,000	37,895	42,467	47,137	52,628	48,140
Rubber	Tons	948	1,069	1,097	1,112½	1,243	1,290
Value (Rising)	£	61,324	79,031	89,467	124,174	129,448	114,949
Coffee Beans	Tons	60½	79	54½	88	83¼	111¾
Value	£	4,994	7,083	5,217	7,536	6,606	6,911
Cocoa Beans	Tons	..	..	..	..	..	..
Value	£	..	..	..	..	..	..
Tobacco	Tons	458	..	..	..	..	..
Value	£	11	..	..	..	..	..
Cotton	Tons	..	..	..	..	..	..
Value	£	..	..	..	..	..	..
Grain Pulse	Bushels	1,636	1,269	828	481	896	558¾
Value	£	1,683	1,079	620	424	727	421
Hemp	cwt.	..	..	..	..	..	..
Value	£	..	..	..	..	..	..
Timber ..	super. feet	10,095	14,485	4,672	1,159	4,618	5,578
Value	£	167	222	77	9	92	119
Bark—Mangrove ..	Tons	..	60¼	15	138¾	200¼	173¼
Value	£	..	337	68	694	1,002	875
Gum	Tons	36	49	30	47¾	73½	65¾
Value	£	727	1,032	650	1,056	2,248	1,576
Sandalwood	Tons	103½	171¾	8¼	7	..	..
Value	£	2,699	5,548	268	85	..	..
Gold	oz.	19,496	21,732	26,199	33,580½	41,308½	64,622
Value	£	45,933	68,922	81,034	87,003	108,141	150,198
Total Exports, Value* ..		249,135	294,743	355,157	524,001	435,593	490,158

* Includes other items—chiefly shell and minerals.

Number of Plantations in Papua.

In answer to a recent inquiry from this Department to the Department of Agriculture in Port Moresby, we were advised that there are 85 major plantations devoted solely to coco-nuts in Papua and 29 plantations with rubber as the sole crop (of which 24 are at the productive stage). There are six plantations producing coco-nuts and rubber in combination. There are also many small holdings on which are planted very small areas of coco-nuts and rubber, but these could hardly be termed plantations.

Importance of the Rubber Industry to Papua.

Rubber production is of decided economic and national importance to Papua, although the production is not yet on a particularly large scale. Reference to Tables 7, 8 and 9 and Graphs I., II. and III. clearly indicates this fact and, at the present time, rubber exports yield between 20 and 25 per cent. of the total income and returns approximately £120,000 per annum to that territory.

The importance of rubber to the internal economy of Papua would be much more in evidence if the gold yields had not also increased in late years, due to new development and increased price of gold. The money expended in oil prospecting has also tended to hide this fact.

It is fortunate that during the period when the income from copra had declined rubber has come to the fore to increase the income and balance the loss from this source. It must be remembered that when rubber is at a low price, copra yields a far larger proportion of Papua's income than at present. The main fear is that the present high prices will not hold and that, after a period of prosperity, depression conditions such as existed from 1929-35 may recur.

Table No. 7 presents details of the exports of primary products from Papua since 1927-28, and it is seen that the four main exportable products are gold, rubber, copra and desiccated coco-nut. Coffee and timber are the only other crops worthy of mention. Graph No. I. shows the quantities and Graph No. II. the values of the four main exports mentioned above. In general, gold production shows a rapidly increasing trend both in quantity and value and with present high prices is the most important export from Papua. Copra has been the most important product from Papua until the last couple of years, when rubber has come to the fore owing to prevailing high prices and increased demand.

TABLE No. 8.—PAPUA—RUBBER PARTICULARS.

Year.	Acreage.	Tons Exported.	Value.	Year.	Acreage.	Tons Exported.	Value.
		Tons. cwt	£				£
1895–96		0 6	..	1918–19 ..	(*a*) 8,598	207	33,010
1896–97		0 16	..	1919–20 ..	(*a*) 8,363	242	41,542
1897–98		0 13	..	1920–21 ..	(*a*) 7,250	220	28,966
1898–99	Probably	0 7	..	1921–22 ..	(*a*) 7,465	85	5,862
1899–00	mainly	(*b*)	..	1922–23 ..	(*a*) 7,171	57	5,907
1900–01	wild	(*b*)	856	1923–24 ..	(*a*) 7,481	304	33,334
1901–02	rubber	(*b*)	928	1924–25 ..	(*a*) 7,846	511	68,507
1902–03		(*b*)	1,029	1925–26 ..	(*a*) 7,728	642	194,849
1903–04		(*b*)	498	1926–27 ..	(*a*) 7,981	761	156,274
1904–05		(*b*)	67	1927–28 ..	(*a*) 8,212	811	102,158
1905–06 ..	..	(*b*)	1,145	1928–29 ..	(*a*) 8,804	470	46,816
1906–07 ..	..	(*b*)	1,385	1929–30 ..	(*a*) 9,012	764	50,640
1907–08 ..	..	(*b*)	483	1930–31 ..	(*a*) 9,075½	785	47,036
1908–09 ..	(*a*) 1,698	(*b*)	113	1931–32 ..	(*a*)10,320	806¼	49,262
1909–10 ..	(*a*) 1,886	(*b*)	904	1932–33 ..	(*a*) 8,796	953¼	56,929
1910–11 (*c*)	(*a*) 2,889	(*b*)	2,054	1933–34 ..	(*a*) 8,993	948½	61,324
1911–12 ..	(*a*) 4,496	(*b*)	935	1934–35 ..	(*a*)	1,069¼	79,032
1912–13 ..	(*a*) 6,256	(*b*)	517	1935–36 ..	(*a*) 9,591	1,096¾	89,467
1913–14 ..	(*a*) 6,606	8 0	1,536	1936–37 ..	10,270	1,112½	124,174
1914–15 ..	(*a*) 6,203	1 0	1,501	1937–38 ..	11,836	1,243	129,448
1915–16 ..	(*a*) 7,671	43½ 0	14,486	1938–39 ..	12,809	1,290	114,949
1916–17 ..	(*a*) 7,760	85 0	26,682	1939–40 ..	12,964	1,345¾	..
1917–18 ..	(*a*) 8,311	144.7 0	37,020				

Papuan estimates are incomplete.

(*a*) The area given for rubber in Papua—means the area taken up for cultivation of the product and only in certain instances, e.g., 1939–40 are the true estimates given. (*b*) Not available. (*c*) In 1910–11, 3,808 was probably the true acreage planted.

The amount of copra produced has remained relatively stable since about 1929; the fluctuations appear to be dependent on the price received. These fluctuations are probably due to more "trade" copra being included when prices are high just as happens in the Territory of New Guinea.

It will be seen that the value of copra exports held pride of place until 1934-35 when for two years the value of rubber exports showed a considerable gain. In

the following two years, however, copra again established an easy lead as to value of production. For the last three years, rubber has easily been the most important agricultural export and is likely to remain so during the war period.

Papua.—Fluctuations in the Amounts of Rubber Exported and the Value of Crude Rubber Production.

A reference to Table No. 8 will show the rubber acreage, the amounts of rubber exported and the value of the crude rubber production from Papua, as far as particulars are available. The amounts and values of copra exports together with the total value of exports from Papua are tabulated for comparative purposes in Table No. 9.

The tonnage, value of rubber exports and the acreage planted have shown a gradual increase over the years. It is seen, however, that although the commencement of rubber planting in Papua was not far behind that in other tropical countries, the industry did not expand rapidly. It would appear that there were various reasons, which were mainly economic, such as the type and amount of labour available, age of the colony and because there were not expansive areas of alluvial or new volcanic land readily available.

In common with other countries, depression periods have had a marked effect on the quantities and values of rubber exports. Copra tonnage and value of exports have not shown such marked fluctuations at similar periods, although the same trends were present. It would appear that, from the figures presented, there has been either little encouragement or little attempt to expand this industry in Papua over the past ten years.

TABLE No. 9.—PAPUA: YEAR FLUCTUATIONS IN TONNAGE AND VALUE OF RUBBER AND COPRA EXPORTS.

Year.	Rubber Exports.			Copra Exports.			Total Exports, All Primary Products, Value.
	Quantity.	Value.	Total Exports.	Quantity	Value.	Total Exports.	
	Tons.	£	Per cent.	Tons.	£	Per cent.	£
1916–17 ..	85	26,682	16.40	2,096	40,882	26.1	156,535
1917–18 ..	144.7	37,020	16.7	3,189.7	68,225	30.8	221,699
1918–19 ..	207	33,010	18.7	2,598	53,264	30.21	176,247
1919–20 ..	242	41,542	15.45	4,080	124,035	46.0	270,481
1920–21 ..	220	28,966	16.8	2,984	68,579	39.7	172,672
1921–22 ..	85	5,862	2.66	5,063	87,377	39.6	220,236
1922–23 ..	57	5,902	3.3	5,870	112,481	62.7	179,452
1923–24 ..	304	33,334	14.0	7,315	136,659	57	239,498
1924–25 ..	511	68,507	18.6	7,765	172,905	47	367,629
1925–26 ..	642	194,849	28.4	8,619	204,097	29.7	685,896
1926–27 ..	761	156,274	34.4	9,542	186,837	41.1	454,462
1927–28 ..	811	102,158	29.2	9,825	194,019	55.4	350,363
1928–29 ..	470	46,816	13.8	12,480	214,051	63.4	337,365
1929–30 ..	764	50,640	15.5	11,693	176,485	54.3	324,775
1930–31 ..	785	47,036	17.1	9,436	93,710	34.1	274,354
1931–32 ..	806	49,262	18.2	10,011	100,454	37.3	269,354
1932–33 ..	953	56,929	20.6	9,686	89,512	32.8	275,866
1933–34 ..	948½	61,324	24.7	8,082	42,990	17.2	249,135
1934–35 ..	1,069¼	79,032	26	8,570	57,597	19.5	294,743
1935–36 ..	1,096¾	89,467	25.2	10,549	100,681	28.3	355,157
1936–37 ..	1,112½	124,174	23	13,600½	191,808	36.6	524,001
1937–38 ..	1,243	129,448	24.25	12,249½	91,166	20.1	435,593
1938–39 ..	1,290	114,949	20.6	9,357¼	57,999	11.8	490,158

It was not until 1915-16 that Para rubber exports showed any particular volume and, by the following year, the amount and value of these exports had almost doubled. There were also considerable increases in the tonnage exported, but not of values in 1917-18 and 1918-19. In 1919-20 the record tonnage (242 tons) and value (£41,542) in the six-year period of high prices, ranging from 1916 to 1921, was exported and then followed a sharp drop in the value of exports in 1920-21, when 220 tons of rubber brought £29,000 (approximately).

In 1921-22 and 1922-23 there was a disastrous slump in the rubber industry when in the first of these seasons only 85 tons of rubber valued at £5,826 was exported and in 1922-23 the exports fell to 57 tons sold for approximately the same value.

In 1922-23, according to the Annual Report,[19] the London prices for plantation sheet rubber were so low during the early part of that financial year that practically all plantations ceased tapping. This resulted in a great loss to owners and a serious decline in the wealth of Papuan production.

It was commented that instead of 57 tons the production should have been approximately 660 tons, as the 7,171 acres planted had then practically all reached a tappable stage.

During 1923-24, with increase in prices, the exports rose to 300 tons valued at £33,000 (approximately). There was a marked increase in tonnage, but especially in value, up to the year 1925-26, when 642 tons brought £194,849, and good prices and returns prevailed for a period of four years. The 1925-26 season still remains the record year for Papuan rubber exports, despite the fact that the quantity of rubber at present exported annually doubles this amount (cf. 1,287 tons in 1938). The quantities and values of rubber exported during the years 1926-27 and 1927-28 remained very satisfactory.

In 1928-29 another sudden and sharp decline occurred and the value of rubber exports slumped from £102,000 in 1928 to £47,000 approximately in 1929. This decline ushered in a long period of depression of rubber values which, besides being responsible for the increased application of rubber restriction in the larger producing countries, led to the granting of legislative assistance in Papua, namely, the "Grant in Aid" provided in November, 1930.

This state of affairs lasted for six years and it was not until the end of 1933 and in 1934-35, when nearly 1,100 tons of rubber valued at approximately £90,000 were sold, that a favorable period for the rubber producers commenced. The "Grant in Aid" was then reduced from 4d. to 2d. per lb. in September, 1933, and was finally discontinued in September, 1936. According to the Commonwealth *Year-Book* (1936) the improvement in price, coupled with Australia's preference, was responsible for the increased exports of rubber during the two years to 1936.

The quantity and value of rubber sheets exports have continued to improve in the main since 1934 up to the present time. The producers have thus experienced approximately six years of prosperity and of these the last four years have been really prosperous years, even allowing for some slight, temporary declines in values at intervals.

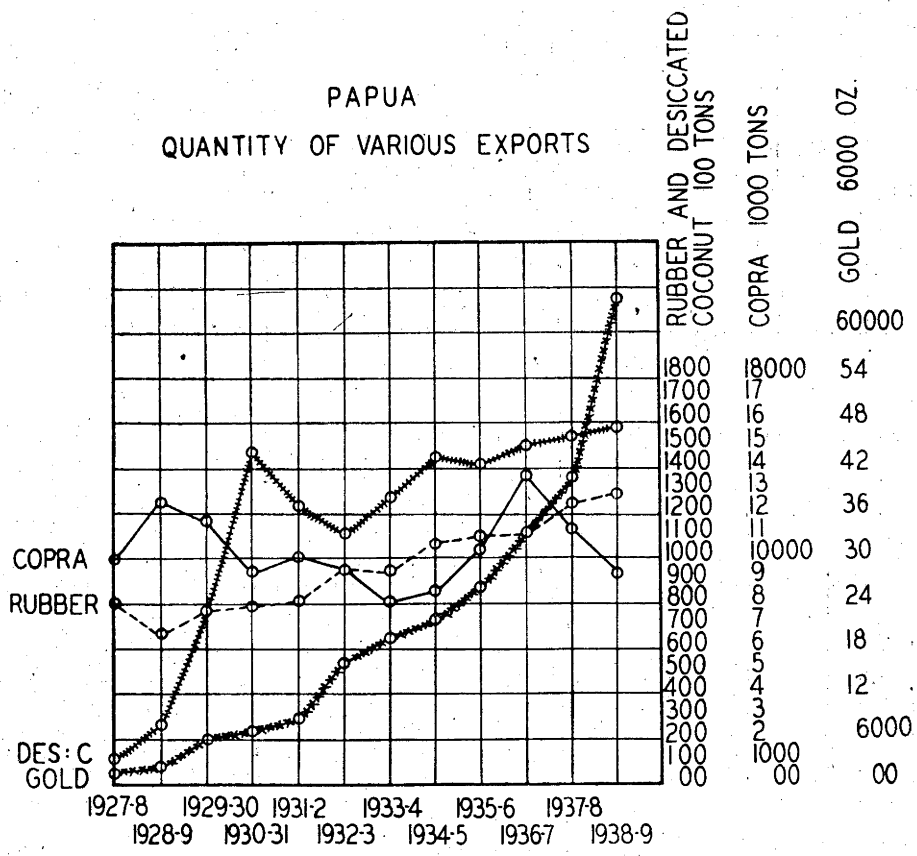
It is readily apparent why producers and intending investors wonder how long this cycle of good years will last and recognize the need for some form of stabilization of the industry. This will be especially likely when the present heavy demands due to war requirements are met.

Reference to Graph No. III. shows, in a comparative way, how the peak and slump periods in copra exports and values roughly corresponded, though to a lesser extent, with those of rubber production and values in Papua. It may be of interest to note that, although much more copra is exported from the Mandated Territory, the peaks and curves in the copra graph, for value exported, *see* Vol. 2, No. 2, *New Guinea Agricultural Gazette,* closely paralleled the fluctuations in Papuan figures.

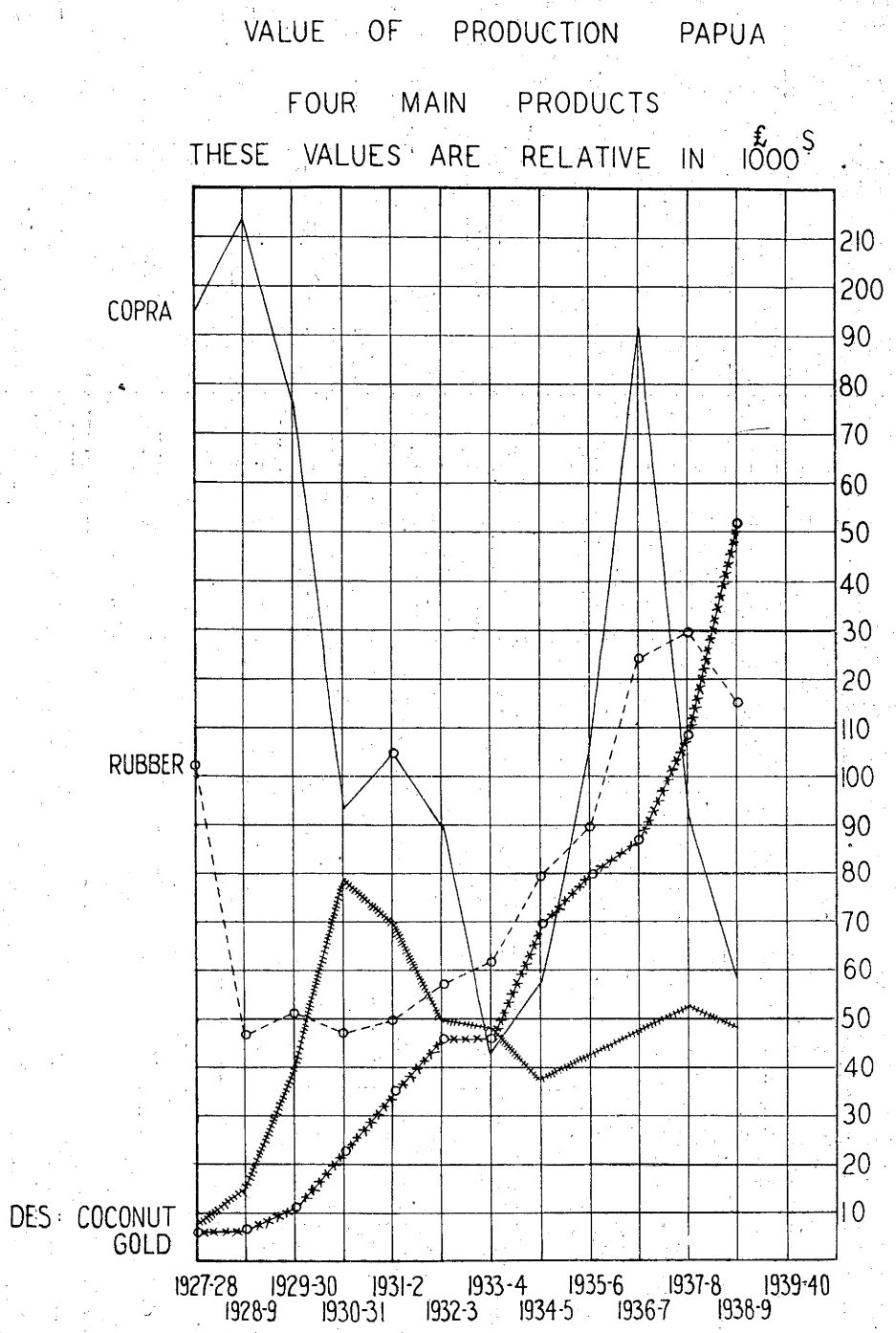
In the Papuan Annual Report for the year 1938-39,[20] the following remarks on rubber appear:—

> Activity in agriculture for the twelve months just concluded (1938-39) has been well sustained and particularly does this apply to rubber growing. The cultivation of rubber in this Territory has now reached comparatively large proportions, and it is to be hoped that the market price of the product remains favorable and thereby rewards planters for the considerable amount of energy and money that has been spent in furthering the industry. Whilst the rubber market has been somewhat erratic, there appears to be no indication in the fluctuations that we are faced with any other than a remunerative market, rather the London market price at the time of writing would tend to forward the view that for some time at least, rubber can be profitably cultivated.

[*To be continued.*]



Graph No. I.


VALUE OF PRODUCTION PAPUA
FOUR MAIN PRODUCTS
THESE VALUES ARE RELATIVE IN £ 1000 S
COPRA
RUBBER
DES: COCONUT
GOLD
210
200
90
80
70
60
50
40
30
20
110
100
90
80
70
60
50
40
30
20
10
1927-28
1928-9
1929-30
1930-31
1931-2
1932-3
1933-4
1934-5
1935-6
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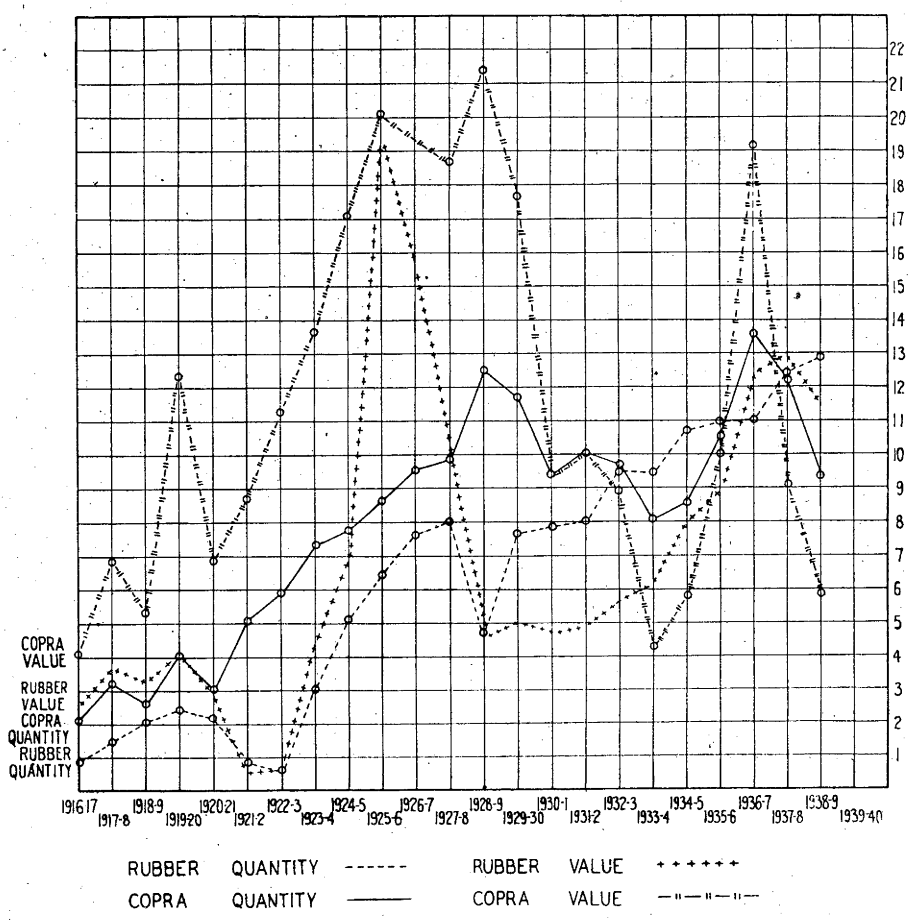
1937-8
1938-9
1939-40

Graph No. II.

PAPUA YEARLY FLUCTUATIONS IN TONNAGE AND VALUE OF RUBBER AND COPRA EXPORTS



Graph No. III.

COCO-NUT JOURNAL.

A copy of Volume I., Number I., of the *Coco-nut Journal* was recently received. This journal is published by the National Coco-nut Corporation, Soriano Building, Manila, and the subscription rate is 2 pesos per annum. The journal is most attractively presented and should prove of great value to all interested in the welfare of the coco-nut industry.