REPORT ON A PLANT VIRUS DISEASE SURVEY IN THE TERRITORY OF PAPUA AND NEW GUINEA—PART I

(Manila Hemp)

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(PART I.—Manila Hemp. The following report by Dr. Magee arises out of a visit which he made to the Territory at the invitation of the Minister for Territories to make a specific survey of various diseases in Manila Hemp and a general survey of the various disease problems in the Territory.)

(PART II of Dr. Magee's report covering the general survey of various diseases will be published in the *Papua and New Guinea Agricultural Journal*, Vol. 9 No. 1.)

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PART I.

REPORT ON A DISEASE SURVEY OF BANANAS AND ABACA (MANILA HEMP) IN THE TERRITORY OF PAPUA AND NEW GUINEA IN RELATION TO THE ESTABLISHMENT OF THE ABACA INDUSTRY IN THE TERRITORY.

This survey was undertaken by the writer during July and August, 1951, on behalf of the Department of Territories, Commonwealth of Australia, with the aim of determining the incidence of the bunchy top disease of *Musa* spp. (edible bananas, wild bananas and manila hemp) in the Territory of Papua and New Guinea and to advise on the quarantine measures necessary to prevent the introduction of bunchy top into the Territory. The survey was prompted by the current world shortage of abaca—the premier marine cordage fibre, and approaches made by commercial interests to the Commonwealth Government and the Administration of the Territory to enter the abaca industry in the Territory.

For some years the Department of Agriculture, Stock and Fisheries of the Territory has been carrying out experiments on the suitability of land for this fibre. Several plots of abaca have been planted at the Keravat Experiment Station, near Rabaul, and small plots are also planted at the Agricultural Experiment Stations at Madang, at Bubia near Lae, at Buka (Bougainville) and at Namatanai (New Ireland). [It is understood that there are also small plantings of abaca at Yule Island (Papua) and at Pondo (New Britain).] Among the propositions made by commercial interests was the proposal to introduce to the Territory planting stock of the Tangongon variety of abaca from North Borneo. This raised with the Administration of the Territory the question of introducing the bunchy top virus from North Borneo (where it is known to be present in both abaca and bananas) and the great danger such an introduction would be to bananas, which in many parts of the Territory are the staple food of the Natives.

The survey was carried out for a period of five weeks, visits being paid to all parts of the Territory that could be reached by aircraft in the time available. Bunchy top is a relatively conspicuous disease in its virulent form and it was possible when travelling by motor vehicle or low-flying aircraft to judge the health of edible and wild *Musa* spp., but frequent surveys on foot were made in most areas. The widest surveys were carried out in the Gazelle Peninsula and the foothills and coastal plains of Mount Lamington, as these areas appeared likely to offer suitable soils and road development for the early establishment of an abaca industry.

It is not proposed to review generally the bunchy top problem of *Musa* spp., but for this purpose reference is made to the literature 3, 6, 7, 9, 10, 17 cited at the end of this report.

Areas Visited.

Port Moresby. (Port Moresby township, Bisianumu Agricultural Station, Mageri Agricultural Officers' Training School, Itikinumu and Sogeri Rubber Plantations, Teachers' Training School, Laloki Plant Introduction Station.)

Rabaul and Gazelle Peninsula. (Rabaul township, Pila Pila, Ratavul, Vunalir, Natawa, Tokeravat, Vuvu Mission, Napapa, Vunadidir, Tenaka, Raluana, Davaun, Pararua, Konga, Matupit, Vunapope, Nunga Nunga and Coast Road to Kubanga.)

Manus Island and Kavieng, New Britain. (Airstrips only.)

Bougainville. (Buka Agricultural Experiment Station.)

Lae. (Lae township, Bubia Agricultural Experiment Station, Bumbi Forestry School.)

Central Highlands. (Goroka, Nondugl, Kerawagi, Banz, Baiyer River, Mount Hagen, Korn Farm, Kainantu, Aiyura Agricultural Experiment Station.)

Wau and Bulolo. (Townships and all roads surveyed.)

Madang. (Township, Agricultural Experiment Station and surrounding roads.)

Wewak. (Airstrip only.)

Portion of Markham and Ramu Valleys. (By low-flying aircraft.)

Popondetta. (Popondetta Station, Higatura, Saiho, Sangara, Awala Road from Embi airstrip to Oro Bay, Aerial survey of roads to Point Killerton, Gona and Buna.)

Kokoda. (Airstrip, School and Kokoda Station.)

Incidence of Diseases.

Bunchy Top.—

No sign of bunchy top disease was seen in bananas in any part of the Territory. This must be regarded as fortunate since the disease is present in a number of neighbouring regions, e.g. Philippines, North Borneo, Bonin Islands, Fiji Islands and Ellice Island and there appears to have been, over the years, a number of separate introductions of bananas, e.g. the varieties, "Java" or Ladies Finger, Cavendish, Gros Michel and Rajah. At least two separate introductions were reported to have been made by the Allied Army during the War, namely Cavendish and Rajah to Korn Farm, Mount Hagen and Cavendish and Gros Michel to Bumbi, near Lae.

Close attention was given to the plots of abaca (*Musa textilis*) growing at the Agricultural Experiment Station at Keravat near Rabaul. The variety is an unnamed one and the history of its introduction is unknown since the records of the Experiment Station were destroyed during the war. It is presumed by the Officer-in-Charge of the Experiment Station to have been introduced from the Philippines about 1930 and at the time of the reopening of the Station in 1946 only a few surviving stools of abaca were found. From these stools and their progeny a number of plots of several acres each have been planted out. A view of the oldest plot planted in February, 1949, is shown in Fig. 1 and of the plot planted in December, 1950, in Fig 4.

No abnormal features were noticed in the plot shown in Fig. 1 and apart from the fact that the variety is one liable to crowded growth of suckers it appeared to be a type likely to be useful for cordage fibre production. The variety appears to be a vigorous one and the lengths of mature stem in most of the interior (and shaded) stools were twelve feet or more to the crown of foliage (Fig. 3).

An examination of the plots planted in December, 1950, and in February, 1951, revealed an abnormal habit of growth. Although the growth of most of the stools was fairly vigorous, the suckers of many, after commencing normally, developed a series of narrow leaves with chlorotic areas and other features which are typical of the symptoms of bunchy top in abaca. These symptoms are illustrated in Figs. 5 to 10 and in the opinion of the writer indicate that at some time in its history this variety of abaca has been infected with bunchy top. It is considered that the variety is carrying a chronic infection which affects the plants only during the early stages of growth.

At one time it was accepted that *Musa* spp., once they became infected with the bunchy top disease, developed the disease in acute form and never recovered. This is still the view regarding bunchy top infection of the Cavendish variety of banana but is now clear that the Veimama variety of banana and certain varieties

Fig. 1.
Plot of Abaca planted at Keravat Lowlands Experiment Station, Gazelle Peninsula, New Britain, in February, 1949. The soil and climate appear to suit this crop.

Fig. 2.

Showing the base of one of the stools in the foreground of Fig. 1. Note tendency to prolific sucker growth, which is considered to be a character of the variety.

Fig. 3.

View in interior of plot shown in Fig. 1 where some of the stems have been cut for fibre extraction. Many of the stems in the interior of the plot, under the influence of beneficial shade, are 12 feet or more to the crown of leaves.

Fig. 4.

Young plot of Abaca at Keravat Lowlands Experiment Station, planted in December, 1950, showing seven months' growth. The stool in the photo is typical of the best, many others were less advanced or less vigorous.

of abaca, following an acute phase of bunchy top infection, are able to make a partial recovery from the disease and the fact that they have been infected can only be determined with difficulty.

The interesting case of the Veimama banana was studied by the writer in some detail in 1938 and is discussed in " Transmission of Bunchy Top to Bananas " published in *Journal of the Australian Institute of Agricultural Science,* Vol. 14, No. 1, 18-24 of 1948. The degree of recovery that is attained by this variety may be judged by reference to Fig. 12.

Until the writer visited the estates of Borneo Abaca Ltd. at Tawau and Mostyn in North Borneo in October, 1950, it was accepted also that abaca (*Musa textilis*) succumbed severely to the bunchy top virus and did not recover. Evidence was found, however, in the North Borneo estates that this was not so. It was seen that following a period in which bunchy top spread in epiphytotic form through the estates, many stools of both the Tangongon and Bangkura varieties, after several months of acute development of the disease began to make a partial recovery, *in situ,* and if suckers were selected from such stools and replanted they made relatively vigorous growth with none of the acute symptoms of the disease. This behaviour of abaca had apparently not previously been noted by investigators in the Philippines where the crop is a major one, but reference to the Philippine literature (1, 2), indicates that attempts that were made there to rehabilitate the abaca industry are based on the selection of plants that had " survived " a bunchy top epiphytotic. It is the writer's opinion that the plants in question did not survive by resisting bunchy top but made a partial recovery following infection.

It is considered that the variety of abaca at Keravat Experiment Station, which presumably came from the Philippines, was derived from stock that had once suffered an attack of bunchy top. There is, in the writer's opinion, no

other explanation of the abnormal habit of growth of the plants in their juvenile stages.

The question arises whether such plants are still infectious and could become a source of virus to other *Musa* spp. in the Territory. Evidence of this was sought in the abaca plots at Keravat and in small plots, derived from Keravat stock, at Madang, Bubia and Buka, but none was found. Examination of neighbouring clumps of bananas and wild *Musa* spp. also did not indicate that natural spread had occurred. (It should be mentioned that the insect vector of the bunchy top virus—*Pentalonia nigronervosa*—is plentiful in Papua and New Guinea.) It would be reasonable to conclude that the Keravat stock is not a ready source of infection since it has been at the Station since about 1930 without giving rise to an outbreak of acute bunchy top in other *Musa* spp. which are fairly common in the neighbourhood. This would be consistent, too, with experience with partially-recovered Veimama bananas in New South Wales. In a plot of two acres of bananas which was planted at Duranbah, New South Wales, in 1938 for yield testing, alternate rows of Veimama, Cavendish and the recovering strain of Veimama grew together for a number of years without any sign of spread of the disease.

It would be premature, however, to conclude that the disease would not spread from the Keravat stock. It is not known whether the virus is actually attenuated or is narrowly localized to certain regions of the plant, for example the growing points. If it is attenuated there is the possibility of the attenuated virus mutating to a more virulent form and if it is merely localized there is the chance that this localization might break down. It is considered, therefore, that it would be unsafe for large acreages of the Keravat abaca to be planted out, as would be necessary in the establishment of abaca estates. As far as is known, bunchy top is not transmitted in the seed and it should be possible by raising seedlings and selecting them for type and vigour to regenerate the variety without the disease risk.

Fig. 5.

Plot of young Abaca, showing in foreground two suckers which after having developed to the broad leaf phase of sucker growth, proceeded to develop narrow leaves, with upturned margins and chlorotic areas in the laminae.

Fig. 6.

Showing the nature of the subsequent growth of abnormal suckers, and the chlorotic margin (which has become necrotic) usually shown by the last broad leaf before the narrow leaves appear.

Fig. 7.

Close up of abnormal leaf growth of suckers. Note the yellowish margin of the broad leaf on left of photo, followed by the appearance of three narrow leaves. The first narrow leaf to appear had a chlorotic margin which has become membranous under the action of the sun. Chlorotic areas were also present in the third narrow leaf to appear and these have collapsed to give an irregular lamina. A sequence of leaves of this type is typical of the symptoms of bunchy top in many varieties of abaca.

Fig. 8.

Showing the subsequent growth of suckers after the development of one or several narrow upright leaves with upturned margins. Two abnormal leaves were developed by this plant which then proceeded to make a " recovery ".

Fig. 9.

In some suckers the development of abnormal leaves is delayed until fairly late in growth. Note habit of the last two leaves of plant in centre foreground.

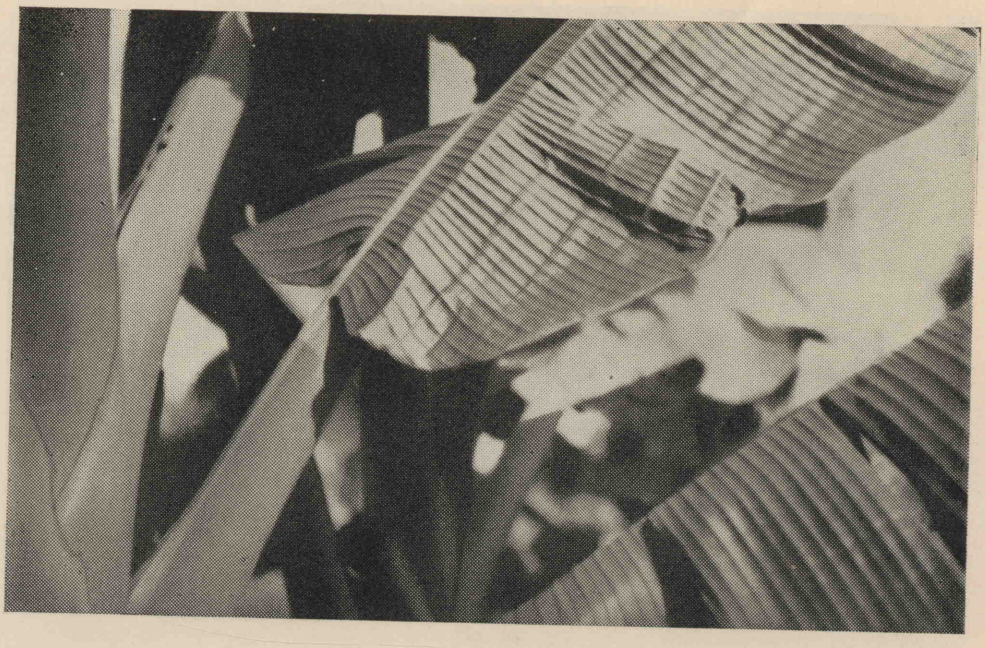

Fig. 10.
Illustrating the " leaf crimp " symptom which is shown by mature leaves of abaca plants which have " recovered " from bunchy top. This symptom is caused by each leaf being choked at its basal end as it emerges from the pseudostem.

Fig. 11.
Illustrating the dark brown streak or stripe which is a symptom of bunchy top in some varieties of abaca. (Quite distinct from the green streaks which are an important diagnostic symptom of bunchy top in the Cavendish and other varieties of bananas.) Caused by the accumulation of brown mucilage in the outer fibres of the mid-rib and leaf stalk. This symptom is often prominent in " recovered " plants of the Tangongon variety of abaca in North Borneo but was encountered only once in the variety at Keravat Lowlands Experiment Station.

Mosaic or Infectious Chlorosis of Musa spp.—

This virus disease, which is caused by a strain of Cucumber Mosaic virus (8, 14) was encountered in the Gazelle Peninsula, at Lae and at Madang. The disease has an acute form and a mild chronic form.

The mild chronic form was fairly widespread in edible bananas in Native villages in the Gazelle Peninsula, but its occurrences at Lae and Madang were restricted to a few localities. Yellow flecks and streaks in the leaves, which are not reduced in size, are the only effects of the chronic form of the disease. The chronic form of the disease is not regarded as serious, and where it is widespread it is considered that it has been propagated by suckers, rather than having been spread by its insect vector.

The acute form of the disease (Fig. 13) was seen on two occasions only in Native villages in the Gazelle Peninsula, where bananas were interplanted with European and Native vegetables. The disease is considered to have spread to the few banana plants which were affected by aphids (*Aphis gosypii*) and other species of aphids, which have migrated from one or other of the vegetable crops, e.g. cucumbers, squash, etc.

Fig. 12.
Stool of Veimama banana which has made a partial recovery from bunchy top, showing normal maturation of the bunch. Note vigour of sucker growth. (Duranbah, New South Wales, 1938.)

Fig. 13.

Mosaic or infectious chlorosis of bananas at Ratavul, near Rabaul. In its acute form, which is illustrated here, the virus (cucumber mosaic) causes intense chlorosis and marked reduction in size of leaves developed after infection takes place. A heart rot of the plant usually supervenes.

Reference is made to this disease here because of the possibility of some observers confusing its symptoms with those of the bunchy top disease. Plants that acquire the disease display symptoms like those shown in Fig. 13, and the affected plants, frequently develop heart rot and die down. Some of the surviving suckers may show pronounced yellow mottling of the foliage and are stunted, but others may show little effect on growth and only minor yellow flecking or streaking of the leaves. Mosaic is a relatively important disease of abaca in parts of the Philippines (14), but in those areas the cannas, weeds and grasses serve as reservoirs of the cucumber mosaic virus from which aphids spread the disease. It is of interest that in no part of the Territory visited were the weeds infected with this virus and in only one instance were cannas observed with mosaic.

Cercospora Leaf Spot.—

This disease, caused by the parasitic fungus *Cercospora musae* is to be seen in every part of the Territory except the Central Highlands of New Guinea, causing spotting of leaves and defoliation. Infection occurs where the leaves are young, mainly as they emerge from the pseudostem, but it is not till four or five weeks later, when the leaves are mature, that the spots appear. Thus, in actively growing plants, the impression is that the disease is not very destructive as there is a crown of apparently healthy leaves. After all leaves have emerged, however, the bunch is thrown and it is common for all leaves to die before the bunch is mature (Fig. 14). The disease reduces the quality of fruit but under present conditions of banana production in the Territory the disease is of little economic importance.

It is of interest, however, that the variety of abaca being grown at Keravat is highly resistant or immune to Cercospora leaf spot.

Fig. 14.

Showing the severe effects of Cercospora leaf spot on the Cavendish variety. The leaves become infected while young but the spots only develop as the leaves mature. After the bunch is thrown no further leaves are formed, and total defoliation often occurs before the fruit is mature.

Other Diseases of Musa spp.—

Although edible bananas are widely grown as a food crop throughout the Territory and wild seeded bananas are to be found in almost every jungle clearing, no serious disease of *Musa* spp., other than those discussed above was encountered during the survey.

Suggested Quarantine Measures in Connection with Musa spp.

Since, with the exception of the widespread development of Cercospora leaf spot, there is no other serious disease of bananas present in the Territory and because of the very great importance of bananas as a Native food crop, every effort should be made to maintain this position.

The two most important dessert bananas of the world, viz. Gros Michel and Cavendish, have already been introduced to the Territory and there should thus be no need to introduce further varieties to satisfy European palates. The Natives largely cultivate a wide range of apparently indigenous varieties (mainly cooking varieties) and there is unlikely to be a need to introduce other banana varieties for Native use.

It would seem, therefore, that the only request that the Administration might receive to introduce a species of *Musa* will be in connection with one or other of the various varieties of abaca (*Musa textilis*). These would be available from only a few parts of the world, viz. North Borneo, Malaya, Sumatra, and Central America. (There is an Ordinance prohibiting the export of plants or seeds of abaca from the Philippines.) The writer has not examined abaca in Sumatra or Central America, but it would be considered unsafe to introduce vegetative parts (suckers or bits) from either North Borneo or Malaya. The only vegetative planting material which would be available from these regions would be from stock which at some time in its history has had an attack of bunchy top and has made a partial recovery.

It is a fortunate feature that most virus diseases are not transmitted in the seed. The cases in which seed transmission occurs, e.g. certain viruses of the *Leguminoseae* and *Cucurbitaceae* are exceptional, and while there has never been an occasion to test experimentally the seed transmission of bunchy top by seeded *Musa* spp. it is the writer's opinion that such transmission is most unlikely. It is recommended, therefore, that if an approach is made to the Administration to introduce true seed of the variety Tangongon (one of the most favoured cordage varieties) the request be granted, provided the seed is grown in isolation and inspected soon after germination by a competent quarantine officer. It would be the safest procedure to make such an introduction through the Plant Introduction Station at Laloki, near Port Moresby, but other propositions for growth of introduced abaca seed in isolation are worthy of examination.

Regarding the plots of abaca at Keravat Experiment Station, Bubia, Madang, Buka and Namatanai, it is considered there should be no further vegetative propagation. The plots at Bubia, Madang and Buka, and at Namatanai if derived from Keravat stock, should be destroyed either by digging out or the use of hormones (5) and the same should be done with the plots of immature hemp at Keravat. The mature hemp at Keravat contains many tons of fibre and because of its maturity is not regarded as constituting an urgent disease risk and could be harvested for fibre if a suitable decorticator becomes available within, say, a year. Otherwise, it should also be destroyed with the exception of about one acre which could be left for seed production until enough seed has been obtained to regenerate sufficient of the variety. When this has been obtained the seed plot should also be destroyed. It is possible that small lots of abaca planting material have been distributed from Keravat to other parts of the Territory and it is recommended these be sought out and destroyed. There was a report that an introduction of abaca was made from the Philippines or Borneo by Mr. Alfred Evensen (now deceased) to Pondo (New Britain) in 1937 and that some of this introduction was planted out after the war in a coconut plantation. The writer did not have time to investigate this report, but it is considered it should be followed up by an Agricultural Officer as soon as possible. The report is stated to have originated from a Mr. Lewis Searle.

Prospects of Establishing the Abaca Industry in the Territory.—

The world shortage of abaca and the present high price have been caused by upset of the industry in the Philippine Islands (4, 16) which prior to the war accounted for 97 per cent. of the world's supply. In 1939 abaca was grown on 722,000 acres in the Philippines and a few thousand acres only were grown in North Borneo, Sumatra and Central America. The main centre of production in the Philippines was in the province of Davao in Mindanao, which in 1940 produced 53 per cent. of the abaca export. The industry there was controlled by the Japanese, who operated well-managed estates. In most other parts of the Philippines, e.g. the Bicol region of Luzon and the Visayan Islands of Leyte and Samar, tenant farmers produced most of the abaca and the conditions of tenure were rather

severe, the landlord usually taking more than half the crop as rent. The industry has not recovered since the War. The banishment of the Japanese led to disorganization of the Davao Estates and the rebellion against landlords and the post-war demand for food crops have interfered with peasant production of abaca. Philippine exports of abaca are now less than 50 per cent. of pre-war and general opinion is that the Philippine abaca industry will take many years to recover.

Central America (Costa Rica, Guatemala, Honduras and Panama) enlarged its production of abaca during the War, but it appears that a good deal of unsuitable land was planted and in spite of full U.S. Government support and the use of mechanical methods, it is doubtful if the industry is yet well established. It is clearly the desire, however, of the U.S. Government to push on the industry in Central America and recently a further allocation of $35,000,000 was made for this purpose. The U.S. Government's abaca interests in Central America are being managed by the United Fruit Company.

The abaca industry in North Borneo is still very small and has recently gone through a severe outbreak of bunchy top and the estates are being replanted. It is understood that little or no progress has been made since the War with the Sumatran industry.

The market prospects for abaca fibre must be regarded as good. The current price of the fibre is about £A300 per ton and it seems that the only fair substitute for it for marine cordage is nylon at more than £A1,000 per ton. Sisal fibre has, however, been substituted fairly satisfactorily for abaca fibre in many cordage uses other than marine.

The prospects of cultivating abaca in the Territory of Papua and New Guinea are considered also to be fairly good, provided sufficient capital is put into the scheme and the right locations for the plantations are chosen. Ample capital would be necessary because it would not be payable to extract the fibre by the peasant methods used in most areas of the Philippines. Machine extraction in factories would be the only method worth considering and this would call for the lay out of plantations with narrow gauge railways as used in the sugar industry. Depending on the size of the project the factories would be equipped with either batteries of hagotans or more extensive equipment such as Krupp decorticators. It would be important to select correct localities for the plantations because high soil fertility and regular rainfall are necessary for high fibre yields and as the product is bulky and non-seasonal, this would call for roads and all-weather shipping ports.

It is considered that soils of geographically recent volcanic origin would prove the most suitable and while there are extensive areas of such soils in the Territory, there is a restriction on availability imposed by the land requirements of the Native population. Many areas also would be left out of early consideration because of inaccessibility.

It is considered that it would be possible to establish the abaca industry in the Gazelle Peninsula of New Britain but it would be difficult there for commercial interests to acquire large areas of arable land in the one locality and it is thought also that cocoa will prove much more suitable as a crop for future development in this region.

The writer was impressed by the extensive areas of arable and sparsely populated land which make up the foothills and slopes of Mount Lamington in the Northern Division of Papua. The slopes extend almost to the Coast towards Gona, Buna and Oro Bay and consist of uncleared jungle and many thousands of acres of relatively level land occupied by kunai and crotalaria. These foothills and slopes occur in the 100 to 150 inch rainfall belt and their soils are derived

from pumice dust from earlier eruptions of Mount Lamington. The soils in the jungle areas have been derived directly from pumice *in situ* but the kunai lands have been formed as silted-up river beds of the numerous watercourses that rise around the slopes of Mount Lamington. There seems little question that abaca could be grown successfully as a crop if the land now occupied by jungle were used, but it is not possible to assess the value of the vast areas of kunai land that occur in this region without experimental plantings. An Agricultural Station was established on kunai land at Popondetta shortly prior to the recent eruption of Mount Lamington and parts of this area which were inspected indicated by the vigour of annual crops that the kunai soil was of moderate to high fertility. It is not possible to forecast, however, whether such land would be suitable for a perennial crop such as abaca. Should trials, however, establish the suitability of kunai land for this crop the great expense of clearing jungle would be avoided.

It is recommended that trial plantings of abaca (selected seedling stock) be made in both jungle and kunai land in the Popondetta and other convenient areas in the Mount Lamington slopes. The land which, because of present road, bridge and port development, would seem well suited for establishing plantations, particularly should kunai soils prove suitable to the crop, is that which lies between the Giruwa and Amboga Rivers. A small port connected by road with this land is being constructed at Port Killerton and excellent airstrips are available at Inonda and Embi for flying in labour lines.

Time did not permit an inspection of the volcanic soils of the Wanigela-Sinapa areas where considerable areas of land are available for agricultural development.

The provision of labour for operating large abaca plantations in Papua/New Guinea could quite well prove the main difficulty, and it is thought this question would need the closest examination. In spite of the best mechanization, a large labour force would still be required for the preparation of land, planting, weeding, harvesting and for factory work. The writer is unable to provide an estimate of the amount of labour which would be required for a mechanized plantation, but the following figures show the size of the labour force which was necessary to operate two plantations, " Tiger " and " Table " which were established near Tawau, North Borneo, by the Japanese in pre-war days. These plantations used batteries of hagotans in the factories for extracting the fibre.

Tiger Estate, 1941.

Total area cleared		4,719 acres
Area planted, mature	1,555 acres	
Area newly planted	392 acres	
	——	1,947 acres

Labourers : 300 Japanese, 800 Malays and Chinese.

Table Estate, 1941.

Total area cleared and planted .... 2,200 acres.

Labourers : 300 Japanese, 800 Malays and Chinese. 660 were employed in fibre production and the remainder for felling jungle, operating saw-mills and other works.

The provision of labour appeared, to the writer during his visit to the Territory, to be the most discussed question among plantation owners. In most areas local labour seems unsuitable or is unorganized and unprocurable, and the copra, rubber and cocoa industries depend largely on the " importation " of labour lines from the Central Highlands and Sepik areas. If the abaca industry were to be established

in the Mount Lamington region, or in nearly any other part of the Territory, it is thought that imported labour would need to be depended on, and the costs involved would need to be taken into consideration.

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