WHAT TO GROW IN THE ISLANDS.

HOW THE NEW GUINEA DEPARTMENT OF AGRICULTURE IS EXPERIMENTING TO ASSIST PLANTERS.

A very valuable and interesting review of agriculture and recent developments in primary production in the Mandated Territory of New Guinea was given by Mr. George H. Murray, New Guinea Director of Agriculture, in an address delivered to members of the New South Wales branch of the Australian Institute of Agricultural Science.

The peculiar merit of the address lies in the fact that Mr. Murray, in addition to giving his expert agricultural knowledge, has made an economic survey of the possibilities of the various plants.

The substance of the address is outlined in the following paragraphs:—

The Mandated Territory of New Guinea, which includes the Bismarck Archipelago, contains about 91,000 square miles. In this vast area climatic conditions vary from the humid lowlands near the coast to the cool mountain peaks over 12,000 feet high suitable for the growth of every crop of equatorial regions. In the early days of the German régime practically all the settlements were confined to the coast. Coco-nuts, being easily grown and suitable for such districts, were the first crops to be cultivated, and remain the staple product to this day, our export of copra being approximately 60,000 tons per annum. (The returns for the year ended 30th June, 1937, being over 76,000 tons.)

In the early days of coco-nut planting in the Pacific, methods of cultivation were more primitive than they are to-day on well-managed coco-nut estates in Malaya and Ceylon. The coco-nuts were planted more or less regularly 28 to 30 feet apart each way and they received very little cultivation, other than to keep the grass cut down, which, as cultivation, is hardly worthy of the name. Several of the plantations in the early stages of the German régime were inter-planted with cotton, the cultivation of which also helped the coco-nuts, and the cotton crop was of some assistance in reducing the labour costs. The low price of cotton to-day, however, hardly warrants the cultivation of cotton in New Guinea even for this purpose.

It should be remembered that there is practically no resting period in plant growth in the tropics, particularly in districts with heavy rainfall. Consequently, weeds are growing all the time, and the methods employed in orchard cultivation in temperate zones are quite inapplicable in the humid tropics. About 25 years ago, therefore, selective weeding and use of cover plants came into practice. The former meant encouraging the growth of leguminous weeds to combat those of an injurious nature.

Cover Crops.

Passiflora foetida was one of the first to be used as a cover plant in competition with the noxious grass, *Imperata arundinacea*, known by various names, in the eastern tropics to which it is confined: In Ceylon it is known as Illuk, in Malaya and the East Indies as Lalang, corruption of the Malay name alang alang, in the Philippines as Cogon, in the Territory of New Guinea as Kunai, in Papua by its Motuan name of Kuru Kuru, and commonly known in

the warmer parts of Australia as blady grass. Its growth in Australia, except in North Queensland, is much less rank than in New Guinea. Incidentally, this grass can be manufactured into paper, a sample of which is on show at the Agriculture Department, Rabaul. Such an industry could never be worked on a profitable basis, however, except on an extensive scale, where the grass could be cut by machinery.

Although *Passiflora* has proved successful in combating kunai in New Guinea, where soil conditions are favorable, it proved quite unsuitable in heavy soil in certain parts of Papua. It is non-leguminous and for that reason was not a satisfactory cover. Experiments over a long period were carried out with other leguminous plants for the control of weeds and noxious grasses and the two creepers *Centrosema pubescens* and *Calopogonium mucunoides* are now in general use for this purpose in the East Indies, and have proved eminently suitable in New Guinea. There was great opposition to and criticism of the use of leguminous cover plants when first recommended by the New Guinea Department of Agriculture, the planters being wedded to the old method of cutting the kunai—with scythes made of suitable sharpened hoop iron—formerly practised by Germans in the early days before the more scientific method of cover plants came into use. Many planters to-day, however, are using cover plants on their plantations, one of whom informed me that since he had established these plants on his property he was able to dispense with a gang of 60 grass cutters. Another plantation of approximately 500 acres is entirely covered with such plants, not a single labourer being employed in weed control. *Centrosema pubescens* takes a considerable time to get established, six to twelve months, but *Calopogonium* grows very rapidly once the plant commences to run, and one planter, who says he cannot remember its name, calls it "galloping home". The latter plant dies back during a continuously long period of dry weather, but the former makes a permanent cover when once established.

In very shallow soil neither plant grows satisfactorily, but coco-nuts will not thrive in such soil either.

Copra Curing Methods.

Copra, the cured meat of the coco-nut, is prepared for market by drying in the sun, over smoke fires, or in specially constructed driers heated by hot air, or in a few cases by steam. The sun-cured copra is the best quality, but only districts having considerable sunshine are suitable for this method. What is known as the Ceylon type of drier is the most satisfactory artificial method of drying. Even with this method, however, it is advisable to give the green (uncured) copra one day in the sun before putting in the drier. This method necessitates transferring the copra from one platform to another for five consecutive days after which it should be of first-class quality. This method was recommended to the planters in New Guinea and plans and particulars supplied by the Department of Agriculture.

Like many new methods that have been recommended it received criticism in certain quarters. One company after a short trial condemned it for the reason that it was said to require 44 units to produce one ton of copra. Another planter in his first attempt at curing in accordance with this method cured his copra at a labour cost of 34 units to the ton, but there can be no doubt that after his

labourers were thoroughly accustomed to the work the labour costs could be greatly reduced. This has been proved, as another planter who has always followed the advice of the Department of Agriculture informed me that his labour cost was 17 units per ton, and he has been producing first class copra, obtaining a considerably higher price than Rabaul sun-dried. The coco-nut planter in New Guinea and elsewhere must realize that the only way to make his plantation pay to-day is to reduce costs of plantation maintenance and improve the quality of his copra by curing in some such method as the Ceylon type of drier. This drier can be modified to suit large or small properties. That such methods are practicable is proved by the fact that a large estate of 18,000 acres in Malaya produces copra at an all-in-cost of less than £5 per ton f.o.b.

Every endeavour is being made by the Department of Agriculture to raise the standard of New Guinea copra by a system of copra inspection by qualified inspectors. The scheme of copra inspection has raised the standard of our copra so that planters have received as much as 25s. per ton over South Sea at which New Guinea copra was previously rated.

Sexava Insect Pest.

Coco-nuts in New Guinea are comparatively free from serious disease, but they are subject to attack by several insect pests common to the Pacific. We have, however, a very serious pest in New Guinea so far unknown to other Pacific islands, but very closely akin to a species in Moluccas and the Taland Group of islands in the Dutch East Indies. It belongs to the family *Tettigoniidae* and the genus *Sexava*. These insects may frequently be present on a plantation for years, but not in sufficient numbers to cause serious damage. Then they may suddenly increase with alarming rapidity, reaching plague proportions. The insects can best be described as long horned tree hoppers, sturdily built and about 4 inches long. They are ravenous eaters and the noise made in the evening by eating resembles a gentle breeze through the tops of the palms. Palms that have been heavily attacked are often stripped of their foliage and resemble an umbrella frame.

Ordinary methods of insect control are quite inapplicable for such a pest. In studying the problem I found that the same, or kindred insect, was found in Amboina in the Moluccas, where it was kept under control by a minute Chalcid wasp, *Leefmansia bicolor*, parasite on the *Sexava* egg. After correspondence with Dr. Leefmans, Director of the Institute of Plant Diseases, Buitenzorg, Java, recommendations were submitted for the introduction of the parasites from the Moluccas to New Guinea and a Government schooner left Rabaul for Amboina with Mr. J. L. Froggatt, entomologist, on board. Mr. Froggatt succeeded in obtaining a large number of parasitized eggs and landed them safely at a field laboratory at Manus, in the charge of Mr. J. F. Caldwell.

Many thousands of local *Sexava* eggs were duly parasitized by the *Leefmansia* and breeding operations were then established. The parasites have been obtained from *Sexava* eggs collected in the field, and we have good reason to believe that they are established in the district. The field laboratory was later removed to New Hanover under Mr. B. O'Connor and his reports showed that the parasites gradually distributed themselves in *Sexava* infested areas on the island. It is too soon yet to say what the ultimate result will be, but we certainly have good reason to hope that this campaign against *Sexava* will be a success.

Other Island Crops.

It is very unwise that any country should depend upon one crop for its agricultural development, and the Department has made every effort to encourage the cultivation of crops other than coco-nuts. About the middle of 1928 operations were started for the development of the Keravat Demonstration Plantation, about 30 miles from Rabaul. Contrary to what has been said in certain quarters our records show that many experiments and introductions of new crop plants have been made there.

Apparently many planters and even officials have the idea that there are many tropical crops at present not cultivated in New Guinea that can be grown profitably by Europeans. In New Guinea such however is not the case, particularly as the only districts at present accessible for development are those comparatively near the coast. Some tropical crops are suitable only for peasant cultivation, or on the other hand, on a very extensive scale, requiring expensive machinery.

Pimento, for which there is but a limited demand, is practically grown only in Jamaica where it is little more than a peasant crop.

Nutmegs take long years to come into bearing and the prices ruling would not justify any planter growing them extensively. It is a crop that requires careful handling and packing. There are a few trees bearing on some of the plantations to which the owners might well give their attention. The nutmegs are extremely subject to insect attack after harvesting and require careful packing. They should be packed in paper-lined boxes weighing 56 lb. each. The nutmegs should be wrapped in paper and the joins or seams of the boxes sealed with adhesive tape.

A few clove trees have also been introduced to New Guinea, but the market for this spice is limited, and more than supplied by Paemba and Zanzibar (British Protectorate) and the Moluccas, Dutch East Indies.

Pepper has been introduced by the Department and is coming into bearing at the Demonstration Plantation and Botanic Gardens. This crop takes about six years to be in full profit and requires as intensive cultivation as a market garden. Ordinarily, the stock of pepper on the London market is 4,000 tons, but there are at present 25,000 tons, and so this crop would be of no assistance in relieving planters in the present copra slump.

Arrow root, ginger, cardamons, and cinnamon are minor crops cultivated at the Demonstration Plantation and Botanic Gardens, Rabaul, but the planter would be ill-advised who entered on their culture extensively, owing to the limited market.

Vanilla, another minor crop grown at the Demonstration Plantation, has greater possibilities, but only as a side line. As is well known vanilla is an orchid, and in New Guinea must be hand-pollinated to get any crop.

The fibre plants, Manila hemp, Sanseviera hemp and Mauritius and jute are all grown at the Demonstration Plantation and the Botanical Gardens, Rabaul, but not one of these could be grown profitably in New Guinea at present, for reasons unnecessary to specify here. An improved variety or sub-species of Sisal hemp (also introduced to the Demonstration Plantation) could probably be grown profitably in New Guinea, but only if grown on a very extensive scale, and under able and skilled management. A great deal of expensive machinery

would be necessary for the successful cultivation of the crop. The same applies to tapioca, although this crop is more easily dealt with. Its production, however, on a profitable commercial scale by European planters requires considerable financial resources on account of machinery for its preparation. This crop is also being grown at the Demonstration Plantation and experiments are to be made in its preparation by simpler methods.

Desiccated coco-nut is also produced, there being three mills in operation, but there is little likelihood of expansion in this industry for the moment.

The Derris Plant.

The leguminous plant Derris is now receiving some attention as a plantation crop, and experiments are being made at the Demonstration Plantation in the cultivation of an introduced species, probably *Derris Malacceasis,* and the indigenous species at present unidentified. A small sample of New Guinea Derris was sent to the Imperial Institute in London, by the Department, and was favorably reported on. Its rotenone content was approximately 4 per cent. and considered equal to the Malay product. The rotenone content in this plant seems to be very variable, and until we have sufficient roots to make a trial shipment to London the Agriculture Department would not be justified in advising planters to enter upon its cultivation. It takes about 21 months from planting before the roots are ready for harvesting. The main toxic property in the roots is rotenone, which is now coming into use for insecticidal purposes.

Adlay, a cereal crop introduced from the Philippines, is growing very well at the Demonstration Plantation, but both Europeans and natives would need to acquire the taste for it before it could ever become an important crop in New Guinea. The grain, however, is appreciated by poultry.

The very few tropical crops left that could be grown profitably in New Guinea are cocoa, rubber, coffee (Robusta and Arabica), tea, cinchona, kapok, West African oil and sugar, all of which are cultivated at the Demonstration Plantation, while tea and cinchona have been introduced recently to the Upper Ramu at 6,000 feet.

Cocoa, Rubber and Coffee.

During the German régime there was a considerable production of cocoa in the colony, but during military occupation such plantations were greatly neglected. Efforts are now being made to revive the industry and according to returns the exports of cocoa in 1936-37 amounted to 132 tons. Mr. E. C. Green, of the Department of Agriculture, who took a post-graduate course at the Imperial College of Tropical Agriculture in Trinidad, was advised before his departure from Rabaul to specialize on cocoa and after his return he was specially detailed to inspect cocoa plantations in the Territory and advise the growers as to how to improve their methods. Before my departure on leave, the Department received very appreciative letters on the work of this officer, and there has already been a decided improvement in some of the cocoa exported from the Territory.

Amongst the cocoa trees in the Botanic Gardens, Rabaul, there are a few trees yielding beans of good type, round full seeds and light colour in longitudinal section. These trees have been selected as mother trees for seed purposes and it has also been proposed to obtain some specially selected high quality plants from Java if regulations in that country permit.

A small coffee industry has been established, there being four plantations of Robusta now coming into bearing.

At the Agricultural Station, Wau, in the Morobe goldfields district, at an elevation of little more than 3,000 feet, the Department introduced Coffee Arabica of the famous Blue Mountain variety from Jamaica. Unfortunately, the station is in private hands, but the trees are yielding heavy crops of excellent quality which find a ready local market. The rich mountain lands on the Upper Ramu and many other parts of New Guinea are eminently suitable for Arabian coffee, high quality tea and cinchona, but it is useless to consider the cultivation of these crops until suitable roads have been constructed into the interior.

Owing to the large consumption of rubber in Australia there are possibilities of this crop being worked on a profitable basis if up-to-date methods are employed. No rubber is produced in the Mandated Territory of New Guinea, but there are plantations in Papua, though I doubt if the maximum yield of dry rubber per acre in the Territory is more than 700 lb. By modern methods of rubber planting now practised in the Dutch East Indies and Malaya, that is by planting budded trees from specially selected high yielding clones, 2,000 lb. per acre or more may ultimately be expected.

By an agreement between the main rubber producing countries it is impossible to get any plant material from these high yielding clones, but if a thorough investigation of the rubber tree were made in Papua by the estate managers there in co-operation with our Department, it is possible that we might discover clones equal to some of the record yielders of Sumatra and Java.

SUMMARY.

1. *Rubber* at low and medium elevations.
2. *Cocoa* at low and medium elevations.
3. *Coffee* Robusta at low and medium elevations.
4. *Coffee,* Arabian, at elevations of 3,000 feet, and upwards.
5. *Tea,* Up-country at elevations of 3,000 to 5,000 feet.
6. *Tea,* Low-country is not proving at all profitable to-day.
7. *Kapok.* Can be grown successfully in many classes of soil, from near sea level to medium elevations.
8. *Sisal Hemp.* Did not prove profitable in New Guinea under German régime, owing partly to unsatisfactory labour. A new variety of species found at the Amani Agricultural Research Station is reported to have double the percentage of fibre as *Agave sisalana,* and to be of much finer quality. The director of that institution has been requested to forward a quantity of suckers to New Guinea for trial purposes.
9. *Tobacco.* There are possiblities for this crop in New Guinea. It is somewhat of a gambler's crop, however, yielding high returns at one time and proving a failure at others, owing to susceptibility to disease and insect attack.
10. *Cotton* has proved to be an unreliable crop owing to climatic conditions.

11. *Derris.* There seem to be reasonable prospects for the cultivation of this crop in New Guinea, as it is coming largely into use in certain insecticides. Several hundred plants were sent from the Botanic Gardens to the Keravat Demonstration Plantation, and the department for some time past has been obtaining information from buyers in England and America, and if the data supplied is sufficient to warrant its cultivation in New Guinea, a bulletin on the subject will be published by the department.

12. *Pepper* is hardly suitable for European cultivation. It is almost entirely grown by Chinese and Malays, and to yield remunerative crops must receive highly intensive cultivation like a market garden. Small quantities, however, are grown on European plantations in Java as a side line.

13. *Spices* and many other minor crops of the tropics are only suitable for peasant or native cultivation, and it will be seen, therefore, that the choice for the European planter is limited.