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Tropical Crops

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Report on a Visit to Noumea, Brisbane, Territory of
Papua & New Guinea and British Solomon Islands
Protectorate by Chief Research Officer,
Department of Agriculture, Fiji,
25 November 1967 - 22 December 1967

As the result of a suggestion by Mr. K. Newton, then Tropical Agriculturalist, with the South Pacific Commission, a study tour was arranged by the Commission for Mr. A.W. Allen, Chief Research Officer, Department of Agriculture, Fiji, to the Territory of Papua and New Guinea and the British Solomon Islands Protectorate to study current projects on tree crops.

Prior to visiting these two territories, Mr. Allen held discussions in Noumea with the Commission's Tropical Agriculturalist and in Brisbane with Mr. W. Bryan of the Tropical Pastures Division and with other Specialists of the Cunningham Laboratories, Commonwealth Scientific and Industrial Research Organisation. Mr. Allen's report on his study tour follows.

Report on a Visit to Noumea, Brisbane, Territory of
Papua & New Guinea and British Solomon Islands
Protectorate, 25 November - 22 December 1967

NOUMEA

On arrival in Noumea on 25 November 1967, the opportunity was taken to review all experimental work in the South Pacific Commission area on coconuts, oil palms, tea, cocoa and coffee with the Commission Agriculturalist, Mr. K. Newton, and with his advice to decide what priorities should be established in formulating a tree crop research programme for Fiji. Every

16082

experiment on tree crops whose existence was known to the S.P.C. at this time was reviewed and reviewed in detail. It was decided that particular attention would be paid to tea and cocoa and oil palms in New Guinea and coconuts in the Solomons and on this basis, the Commission formulated a study programme for acceptance by the Director of Agriculture, Stock and Fisheries in New Guinea and the Director of Agriculture, British Solomon Islands Protectorate. In drawing up this programme coffee was given a second priority as the time factor did not allow a visit to the Highlands Experimental station at Aiyura in New Guinea.

BRISBANE

At the suggestion of the Director of Agriculture, Fiji, the opportunity was taken to break the journey to New Guinea at Brisbane in order to enable the writer to meet Mr. W. Bryan of the Tropical Pastures Unit at the Cunningham Laboratories, C.S.I.R.O., St. Lucia. Only one day was available for these discussions.

The pasture research programme which was formulated by Mr. Bryan for Fiji was discussed at length bearing in mind the limitations of staff and finance and the priorities which had been agreed between Mr. Bryan and Mr. Roberts of this Department were confirmed. Mr. Bryan also had very kindly arranged that specialists in other fields of tropical pasture research were available for discussions and the opportunity was also taken to discuss the proposed stage II of the soil survey programme for Fiji with Dr. Hubble of the Division of Soils, C.S.I.R.O.

Among other officers with whom discussions were held were Dr. Hutton, Deputy Director, Dr. Andrews on grass and legume nutrition and methods of experimentation associated with this type of investigation and Dr. Hegarty who has investigated and isolated toxic compounds in various legumes notably *Leucena leucocephala*.

The possibility of a visit to Fiji by Mr. Bryan was discussed and it was agreed that little purpose would be served by a visit in early 1968 as had been suggested previously. It would be better to postpone this visit, till later in the year when the experimental programme was well under way and a suggestion that September 1968 would be suitable was agreed to.

NEW GUINEA

On arrival in New Guinea on 1 December informal talks were held

with Mr. A.W. Charles, Acting Director, Department of Agriculture, Stock and Fisheries and Mr. G.K. Grahame, Senior Soils Survey Officer and Acting Chief of the Division of Plant Industry, and changes were made in the proposed itinerary to coincide with that recommended by the South Pacific Commission. In the afternoon discussions were held with Mr. A.E. Charles, Economic Botanist, on projects involving tea, oil-palms, coffee and cocoa. In view of the fact that it was impossible in the time allocated to visit Aiyura in the Central Highlands, Mr. Charles discussed the research programme which had been undertaken on Arabica Coffee at this station.

COFFEE: Mr. Charles in these discussions stated as a background that coffee, chiefly Arabica, rivals cocoa as the Territory's second most important earner of income, having increased from 34 tons in 1951-2 valued at \$A 20,000 to 8,687 tons in 1964-5 valued at \$A 296,000. Since then expansion has been slower because of restrictions imposed on planting in accordance with the International Coffee Agreement.

In view of the rapid expansion of the industry, the Department has found it difficult to keep ahead of the industry in research but few problems have arisen and most planters have done well. The research programme on Arabica coffee is centred at Aiyura at 5,000' in the Central Highlands. The programme includes variety trials and selection work, management studies such as shade effects, spacing and pruning methods and their interactions with one another, nutritional requirements and responses to mulching and cover cropping. Yields are recorded as weight of fresh cherry and no conversion into processed coffee has been done. In addition to the trials carried out at Aiyura, trials at Korn Farm in the Western Highlands and Goroka in the Eastern Highlands have been carried out as well.

Variety trials: The principal varieties studied include Blue Mountain (a pre-war importation), Bourbon, San Ramon from East Africa, Mocha and Arusha from East Africa, Hawaiian Cona from Hawaii and Dalle Mixed Green. All these importations were made prior to 1960. Subsequent to 1960 a further 30 varieties free from coffee leaf rust (*Hemileca vastatrix*) have been introduced from the U.S.D.A. Beltsville Maryland and from Portugal. The main variety trials A.C.A. 2, 9, 18 and 23 showed that the varieties, Arusha Bourbon and San Ramon, compared well with Blue Mountain. Hawaiian Cona did not perform well in comparison in the trials.

Further testing is in progress. Most of these variety trials included two or more spacings as varieties differ in their vegetative vigour. Results however in these comparisons have been inconclusive because of low precision.

In two trials ACA 5 and ACA 10, progenies of individual high-yielding trees, have been tested. Average yields of the progenies of selections were no higher than that of unselected seedlings indicating that bulk selection of apparently superior trees for seed parents is ineffective for improving yield. A comparison of the selections as clonal material showed little correlation between the relative performance of clones and progenies and the indications are that clone testing will not be an effective method of selecting parents. Further comparisons have been made between self-pollinated and open-pollinated progenies of the selected parents to assess whether open-pollinated progenies would yield in the same order as the self-pollinated progenies. The general findings were that the order of yields were the same and progeny testing based on open-pollinated seed would be as effective as those from self-pollinated seed.

Spacing trials have compared densities of between 600 to 1000 trees per acre mostly on triangular or square spacings but hedge spacings have also been compared in this programme. In general within the range 7-9' triangular, yields have been higher at the closer spacing but management problems due to overcrowding become apparent. The present recommendation is 8' in the triangle but it has been pointed that the initial advantage of the closer spacing is lessened as the trees grow older.

Hedge spacings with wide gaps between the rows have not yielded well in comparison with triangular spacing.

A considerable amount of work has been done on shade at Aiyura, Goroka and Korn Farm. Interactions between shade, fertilizer and mulching have been noted and tentative general conclusions from this work are:

- (a) that temporary shade is essential for establishment;
- (b) where drought conditions prevail shade is essential; and
- (c) in high rainfall areas with no marked dry season, coffee can be expected to survive without shade provided that mulching and fertilizing are practised.

With regard to fertilizer trials, a wide range of experiments are at present going on in the Highlands. These are long term trials and are of two types, investigating diagnosis and rate of application. They are expensive, and complicated and take a long time to produce positive results. The results also cannot be extrapolated from area to area.

The principle basis on which fertilizer recommendations are made is from foliar analysis, correlating them with visual symptoms of deficiencies (no toxicities have been recorded) and following these up with simple confirmation trials.

Unfortunately owing to lack of time it was not possible to meet Mr. P.J. Southern, the Department's Senior Chemist, for further discussions on these trials.

TEA: A visit of four days was organized at the Tea Experimental Station, Garaina. Because of an accident to an aircraft on the 2nd December, arrival at this station was delayed by a day.

This station was established as a pilot commercial plantation and commenced production in 1962. The station is situated on a high level plain 2400' above sea level and soils consist of strongly leached sandy clays on strongly weathered lacustrine alluvium with low reaction and low-base status. The soils have been shown to be markedly deficient in sulphur and responses to other elements are becoming apparent in plucking tea as it grows older.

About 420 acres of the area are under cultivation with about 30 acres maintained as a plucking unit, the remainder having been allowed to grow away for seed production for which there is a tremendous demand for new plantings, chiefly in the Western Highlands.

Average annual rainfall is 110" with a so-called dry season from May through to September, the monthly rainfall during this period rarely being less than 5".

Planting material is predominantly South Johnstone (Betjan), Arrau (a polyclonal South Johnstone selection), Boh (Maniquiri), Ceylon (China Hybrid) and Sarawak (China), the main emphasis however is being placed on the South Johnstone jats.

A factory designed for processing C.T.C. tea is installed on the plantation, this however is not producing at the moment in view of the fact that the main effort on the plantation is directed to producing planting material for distribution to estates and settlement schemes.

The first two days on the estate were spent in a study of general tea estate management ranging from seed production through nursery stages, planting out, techniques in establishing a proper plucking table and

harvesting methods. The third day was spent on the processing side in which the Estate Manager, Mr. A. Hutton, went over the entire process of tea manufacture in a modern factory. In addition, the harvesting, grading and packing of tea seed for outside areas were studied in detail.

With regard to actual research work done at this plantation only two experiments are progressing at the present time. One is a trial comparing the production of plucking table by pegging selected leaders on the bush versus pruning. The second is a factorial trial with plots split for shade and no-shade, investigating the effect of N,P,K and Mg. Both these trials are still in progress. However in the pegging-versus-pruning trials the indications are that while tea bushes can be brought into plucking 6 months earlier by pegging, than by pruning, the economics of pegging would militate against its general adoption by the Department.

From Garaina, advantage was taken of a charter service to proceed to Mt. Hagen in the Western Highlands where 2 estates under the management of Mr. Manton and 2 small holder schemes involving tea were inspected. A considerable amount of travelling by road was involved.

Of the two estates visited, in the company of Mr. J.G. Morgan, Agronomist, one was on drained peats about 8 miles from Mt. Hagen the other on gently rolling country about 18 miles away, both were in the development stage, one due to come into production in early 1968 on completion of the factory, the second due to come into production in late 1969 early 1970. The soils on which the estates are laid out are in the one case peaty swamp soils consisting of a deep peat layer overlying pale yellow to yellowish brown and grey silty loams and silty clays. They respond to drainage, normally to 4', this being accompanied within 12 months by shrinkage up to 15" which up to the present appears to have stabilized. On the terraced estate the soils are strongly-weathered, strongly-leached tropical red and yellow loams developed on Pleistocene andesites. The reaction of the peats, which are grass peats (Phragmites), is high being of the order of 5.5 to 7.0, the soils on the andesites being much more acid.

An extensive small holders scheme is being developed by the T.P.N.G. Government on peat soils surrounding the first estate and is based on 10 acre units with 8 acres under tea and 2 acres under general farm crops. In only a few cases have the plot owners been persuaded to build houses on the sites, in most cases they prefer to live in their villages normally in the foothills of the main range and travel down to work with their families.

A similar scheme was examined at Nonidugl about 65 miles from Mt. Hagen on the Lae road which is within easy access of a producing estate at

Minj and within walking distance of a District Agricultural Station from which daily inspections of progress are made.

In general, cultivation methods practised on the estates and small holder schemes were similar, tea seed being brought in from the Government Experimental Estate at Garaina and then after germination planted out in prepared nursery beds generally 4' wide and dug to a depth of 2' at a spacing of 5" x 5". After approximately 18 months in the nursery, plants are cut to a stump 4" above the ground and planted into holes already prepared generally to a depth of 18" and at a spacing of 5' x 2'6 inches, giving a density of 3500 plants per acre. At Garaina a shade of *Crotalaria* is planted between rows and additional top shade is provided in the early stages with bracken or grass. Light shading generally by *Albizia stipulata* is practised but this tree has several undesirable characteristics.

Prior to planting out, thorough cultivation is required and on flat land artificial drainage is necessary. This is also stated as being necessary on gently sloping land and on more developed slopes, terraces at the appropriate spacing must be constructed and normal conservation practices implemented.

Maintenance of the planted crop must be carried out regularly particularly with regard to elimination of weed growth and tractor-mounted, row-crop implements are useful in the early stages of development.

With regard to the formation of the plucking table, annual pruning is carried out in the early years to develop the shape of the bush, although at Garaina a system involving pegging is under trial. The pruning cycle at this latter station is three yearly but it is considered that at higher altitudes this may be increased to four years.

At present in the Highlands of New Guinea, all tea is produced from seed. A programme involving selection of mother bushes and an investigation into the production of clonal material from cuttings is being initiated by the Division of Plant Industry in early 1968.

The principle implications which have a bearing on tea growing as an industry for Fiji are the following:

1. Prior to the establishment of the industry, the Department made a major programme of investigation into the general agronomy and management of the crop at a station at Garaina.
2. The second stage lay in the encouragement of large economic units, namely estate groups, to plant tea generally in units of 1,000 acres or more after it had been established that an acceptable grade of tea can be produced under local conditions. These large units are complete with modern and economic processing machinery.

3. The third stage lies in the development of viable small holder schemes centred on larger processing units generally based on 10 acre blocks, 8 acres under the crop and 2 acres for general household, subsistence and orchard crops. The development of these schemes is timed so that the nucleus estate comes into production a year ahead of the small holder and the produce is sold by the small holder to the operating factory at a price agreed between the Department acting for the scheme small holders and the factory.

This forms the correct basis for the establishment of a tree-crop-based industry in a new area and involves an investigational stage carried out by Government in which the requirements and management of the crop are established by research. Development is then initiated by large scale units of industry and finally small holding units, with assistance from State Development banks, are brought into the industry under Departmental control.

OIL PALMS: Three days were spent at Cape Hoskins where a major scheme, involving an agreement between the Territory of Papua-New Guinea Government and Harrisons and Crosfield (ANZ) Ltd., involves the setting up of a nucleus estate of 5,000 acres with surrounding small holding units totalling 5,000 acres. The principles behind the joint scheme are that the Company will be responsible for the establishment of the estate using germinated seed imported from Malaya from Klanang Bahru Estate, Banting, Selangor, and will also be responsible for the supply to the small holders of planting material which will be raised by the estate to the field stage. The Company will set up a factory of sufficient capacity to deal with 10,000 acres. Small holding units are 10 acres with settlers based and living on their holdings of which 8 acres are devoted to oil palms and 2 acres to cash and household crops. The Department of Agriculture, Stock and Fisheries is responsible for the day-to-day coordination of work and other departments such as the Public Works are responsible for ancillary services such as water supply, roads and building of the central community centres. The system adopted is a compromise between that practised by the State of Sabah, Malaysia, Department of Agriculture, whereby settlers live and work on their plots and that of the Federal Land Development Authority, Malaysia, whereby all essential services such as schools, community centres, shops etc. are located in a central village in which the settlers live. The scheme is so designed that no small holding is more than 2 miles from a central community centre and the roading is being planned to take account of an essential premise in oil palm estate practice that a harvester does not have to walk more than 10 chains to a collecting point. Oil palm planting material is all high-yielding Tenera material planted out as

germinated seed in large poly bags, thus by-passing the pre-nursery stage and establishment in the field which is just commencing on the estate after 15 to 18 months. The scheme is so designed that harvesting from small holdings will be a year behind that of the estate and at the time of my visit the estate was on the point of transplanting the first 500 acres into the field and small holder areas had been demarcated and subdivided and were being cleared. Covers which are supplied by D.A.S.F. are the standard Malaysian covers, *Pueraria*, *Centrosema* and *Calapogonium* sown as a 2:1:1 mixture with interrow plantings of *Flemingia congesta* in order to restrict the flying of rhinoceros beetles.

Settlers from the New Britain area are given priority for land within the schemes and clearing is done by potential settlers paid at the standard daily rate. Once settled they are debited with a fixed cost of \$12.75 per acre which includes wages and a normal charge for incurred costs such as transport. The settlers are also debited with cost of housing, planting material and a proportional cost for ancillary services such as roads, water supply etc. their total debt amounting on establishment to about \$1975.00. Repayment is based over 9 years and yields are calculated at a sliding scale based on a percentage of oil to bunch which increases with maturity to a maximum after 4 years from the initial harvest. The small holders' budget is based on an assumed yield of 8 tons of free fruit bunches at maturity whereas the estate is calculating their budget at 11 tons of F.F.B. to the acre.

The scheme is well-conceived and being put into effect with considerable efficiency and enthusiasm although it can be said that in spite of the excellence of the soil and climatic regime for this crop prevailing in the Cape Hoskins - Talasea area of New Britain, a considerable emphasis has been placed on extrapolation of data and yields from Malaysia. Eight tons of F.F.B. per acre is a high yield for small holders and it may be that the settlers may not be able to carry out the high standard of maintenance and management which would be necessary to obtain and retain these yields, bearing in mind that the work is done by family units who are also responsible for harvesting the crop.

Provision for research on this crop is being made by the appointment on secondment to the joint scheme of an agronomist whose emoluments are shared between the Company and the Department.

Overall coordination between departments concerned in the small holders scheme is the responsibility of the District Agricultural Officer who has a qualified Agricultural Officer in charge of the small holding schemes and a project manager who is a qualified ex-Malaysian planter.

COCOA: A day was spent at the Lowlands Agricultural Research Station at Keravat near Rabaul in discussions on experimental agronomy etc. and a further day visiting two cocoa estates in the Gazelle peninsula Rainau Cocoa and Coconut Estate and Rum Valley Cocoa Estate in the company of Mr. M. Jones, District Agricultural Officer.

In the past a very comprehensive programme of research on cocoa has been carried out at this station. Unfortunately the incidence of Botryodiplodia theobromas dieback has effectively wrecked every experiment and the entire cocoa research effort is now devoted to selection and breeding of dieback resistant varieties. In the past, experiments covering a wide range of investigation into seed-testing, clone-testing, spacing trials, shade-spacing trials, shade-level trials, seedling-spacing trials, shade-spacing-fertilizer trials, cutting-spacing-pruning trials and fertilizer trials on cocoa interplanted with coconuts have been carried out.

A considerable body of information has been built up but it must be stressed that this information is applicable to New Guinea conditions only and particularly to those prevailing in the islands of New Britain, New Ireland and Bougainville where the cocoa is developed on soils of remarkable fertility and ideal climatic conditions.

It is also apparent that the success that the New Guinea authorities and planting industry have obtained with underplanting of cocoa under coconuts is due to their outstanding soil conditions in contrast to the lack of success which this system of crop husbandry has shown in Malaysia, Indonesia and Fiji. This reinforces any arguments about the dangers of transplanting ideas obtained from one area wholesale into another territory without careful evaluation.

BRITISH SOLOMON ISLANDS PROTECTORATE

I arrived at Honiara at 4.30 p.m. on the 19th December after an all day flight from Rabaul. Discussions were held with Mr. F.M. Spencer, Director of Agriculture that evening and on the morning of the 20th December a 1½ day visit to the Lever Pacific Plantation Ltd. at Yandina, in the Russell Islands Group, was made for discussions with Mr. M.A. Foale, Agronomist, and Dr. R.A. Whitehead, Plant Breeder, for the Joint B.S.I.P. Lever Plantations Coconut Research Scheme.

COCONUTS: The Company initiated coconut research on their 12,000 acres estate in 1952 and until 1960 was responsible for all the research work on this crop. With the appointment of a Coconut Agronomist by the Government

of the Protectorate, the Department of Agriculture also assumed responsibility for this aspect of the work and a joint agronomy scheme was initiated between Government and the Company.

In 1965 the scheme was expanded to include a Plant Breeder and since 1966 costs have been shared equally between the B.S.I.P. Government and the Company.

Since the inception of the programme in 1952 a considerable amount of work has been done and in general the experiments can be said to fall into these groups -

- (a) Fertilizer experiments on old palms
- (b) Replanting experiments
- (c) Maintenance trials on young palms
- (d) Miscellaneous

The last group includes variety x spacing x fertilizer trials, trace element trials and arboricide trials.

(a) Fertilizer trials

A trial investigating yield measurements (Lingatu No.1) of annual N,P,K applications on deep brown clays is due to be wound up at the end of this year 1967. Responses to K have been significant but not economic. A similar trial (Lingatu No.2), but on shallow rendzinas with limestone outcrops, showed that reaction to K was very significant. A significant interaction between N and K was obtained. Treatments however were uneconomic.

A fertilizer and ripping trial was initiated at Pepesala in 1952 and laid out as a non-factorial trial. Treatments including ripping (1 year), cattle exclusion (4 years) and N, P and K treatments for 5 years. Ripping had no effect. Fertilizers gave very large responses and K application on its own was shown to have almost as large a response as NPK. Although fertilizer application was stopped in 1957, the residual effect was still apparent in 1966.

(b) Replanting Experiments

A replanting and fertilizer trial at the same estate compared large and small planting holes, N,P & K application and different rates of removal of old palms. Response to K is very high and very economic. In the absence of fertilizer small holes gave better growth. In the absence of K, better growth was obtained in large holes.

A second replanting and cultivation trial at Banika investigated 4 levels of N and K, P and Mg and Cultivation versus Handbrushing, the latter being subsequently replaced by an arsenical weed-killer. The experiment is on 10 year old FMS palms. The trend in yields tends to be in favour of non-cultivation and, in general, K application is more effective on non-cultivated plots. Cultivation alone appear to be detrimental to yield.

A further replanting experiment is being undertaken at Banika in which four rates of removal of old palms were combined with presence and absence of root-pruning of the surviving old palms. This experiment is still in its early stages and it is expected that the relevant value of the different treatments will show up in the long term.

Indications in differences in early yields suggest that complete thinning was giving a greater percentage of flowering at $5\frac{1}{2}$ years than the other treatments and that root pruning reduces yield of the old palms and has a beneficial effect on the young palms in the uncleared plots. No indication of any benefit to the young palms on the half cleared plots was noted.

Miscellaneous trials

One large scale variety, spacing and fertilizer trial at Loavie involved 4 varieties (local tall, F.M.S. Samoan and Rennell Islands), three densities (30, 86 and 108 palms to the acre) and three fertilizer treatments. This experiment has been written off because of severe damage incurred as a result of two typhoons. A second trial of this nature is due to be established at Banika, the treatments proposed being a comparison of tall and tall X dwarf hybrids (controlled pollination), two densities and two pairs of fertilizer treatments; the experiment is being laid out on sandy coral soil.

In addition to the trials described above, three nursery trials are in progress. The first is a $2 \times 2 \times 2$ factorial which sets out to study the effects of 2 watering treatments, two sizes of seednuts and comparing conventional nursery-seed-bed techniques against large poly-bags. The second is a poly-bag and selection trial which aims to compare conventional nurseries against poly-bags and comparison of ages of transplanting at 4, 7, 10 and 13 months. The growth of the best 50% is compared with the remainder.

A further nursery trial on look - see basis is investigating the water requirements of seed in a poly-bag nursery.

Finally, a small trial is in progress to test the viability of seednuts exposed to sea water.

Plant Breeding

From the inception of the research scheme in 1952 the emphasis has been largely on agronomic work.

However in 1965 a Plant Breeder to the Scheme was appointed and the basis laid for research into available material suitable for the production of varieties superior to the Solomon Island Tall Palms. Basically the programme is designed to take four stages into account.

- (1) Immediate stage
- (2) Short term stage
- (3) Long term stage
- (4) Very long term stage

(1) The immediate stage is concerned with producing the best possible seed from existing plantings, based on FMS material introduced in 1914, special FMS material which is a hybrid between part hybrid (FMS x SIT) x SIT and dwarf hybrids based on Fijian Tall x MD originally from Sigatoka.

(2) The short term stage carries the hybrid principle further and consists of the establishment of large seed gardens planted with selected Malayan Dwarfs under Solomon Islands, FMS and Rennell Island Tall, the aim being to produce some 230,000 seeds per annum.

(3) The long term stage is directed at higher yielding strains of the three varieties (FMS, Rennell and S.I.T.)

(4) The very long term stage will be aimed at producing new varieties from the hybrids now being developed.

The original programme was drawn up by Dr. A.S. Duff who has now returned to the Congo and Dr. R.A. Whitehead who has taken over from Dr. Duff proposes to modify and enlarge the programme to take account of the large number of introductions made in recent years and now just coming into bearing. He also proposes to initiate a general programme of botanical studies which will be complimentary to his amended breeding programme.

COCOA: In the afternoon of December 21st, a brief discussion was held with Mr. D. Friend, Agronomist, who is in charge of cocoa work in the Protectorate, on the current programme at the Research Station at Dala.

Initial discussions were also held with him and the Director regarding closer co-operation between the two territories in a breeding

programme on this crop, which may be initiated in Fiji. This was felt to be of considerable importance to both territories in view of the narrowing range of countries from which it is now possible to introduce breeding stock owing to the dieback disease in New Guinea and the recording of a new virus disease of cocoa from Sabah.

CONCLUSIONS

The most important factor which this visit brought out was the vital part played by research organizations in proving new crops and getting them established in a country via a three fold line:

(1) government research on a considerable scale involving large research stations generally on a monocrop basis in which the basic agronomy for the particular environment is established and the crop proven from establishment to final processing, followed by

(2) establishment on estates where establishment of processing is involved and finally

(3) the inclusion of small holding schemes associated with a nucleus estate which looks after the processing of the crop to acceptable commercial standards.

It was apparent that where the basic information on tree crops has been obtained first and a crop proven, private enterprise will take on from there and establish the basis of an industry. This is amply proved with the success of New Guinea in establishing a cocoa, tea and coffee industry. In the Solomons where the required basic knowledge particularly in cocoa was lacking, the industry has run into trouble and the same can be said for Fiji.

Another factor which was impressive in New Guinea was the full use the Department of Agriculture, Stock and Fisheries made not only of agricultural scientists and extension officers in establishing plantation industries but also the vital part played by skilled and trained plantation experts at the managerial level both on research stations and in connection with small holders schemes. This has proved a wholly admirable, acceptable and workable arrangement and the skill and knowledge which these plantation experts have brought into both the Government and private sector have been a very considerable factor in getting these industries off the ground with the minimum of trouble and delay.

In the Solomon Islands, the Coconut Research Scheme operates under almost ideal conditions in that it is based on an estate where the scope for experimental work is unlimited. However, the soils on which it is based fall into two categories, shallow rendzinas and leached calcareous red earths and these soils are not representative of the coconut-producing areas outside the Russell Island Group.

It is of interest to note that, in a recent recommendation issued by the B.S.I.P. Department of Agriculture, in spite of trials having been carried out continuously for nearly 16 years, their recommendations for fertilizers are tentative.

ACKNOWLEDGEMENTS

I would like to express my thanks in particular to Mr. K. Newton until recently Tropical Agriculturalist, South Pacific Commission, for organizing this visit and for his hospitality at Noumea. In addition my thanks are due to Mr. A.W. Charles and Mr. G.K. Graham for organizing the details of my visit in New Guinea and to Messrs A.E. Charles, A. Hutton, A. Richardson, J. Morgan, M. Meade, J. O'Donoghue, P. Hicks, J. Sumbak and M. Jones for valuable discussions and hospitality in New Guinea. In the Solomon Islands Protectorate I am indebted to the Director of Agriculture, Mr. F.M. Spencer, for organizing my visit to Yandina and to Mr. M.A. Foale, Dr. R.S. Whitehead and Mr. D. Friend for extremely useful discussions on coconuts and cocoa.

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