



NOTES ON VISIT TO SARAWAK 2-5 MAY 1971

J. K. COULTER

A. SOIL SURVEYS Soils Survey needs which were reported were:-

1. Completion of the reconnaissance soil survey:

- (1) About 35% of Sarawak has been surveyed and much of the remainder is too steep for agriculture, but there are small pockets suitable for development. In some areas, particularly in the 1st Division, there is fairly intense pressure on land from the shifting cultivation system of the Ibans. Six man years are proposed for completion of the reconnaissance survey but based on our experiences in Sabah I would suggest that the job could possibly be done in four man years providing additional transport, e.g., helicopters, is available.
- (11) A request for technical assistance for this survey had gone to the Economic Planning Unit (EPU) in Kuala Lumpur but had been turned down as being of low priority. This was discussed at a subsequent meeting in the E.P.U. and Enche Noor Hassan, Deputy Head of the Unit suggested re-examining the request in order to take more account of Sarawak's priorities. I emphasized that we liked to be forewarned about future requests so that we could re-deploy our teams as efficiently as possible, so a request for help on this survey may emerge eventually.

2. F.A.O. forestry inventory:

- (1) This covers eight areas of about 3 million acres in Sarawak; this is part of a larger F.A.O. project in Malaysia of which Ken Sergeant is the Project Manager. Some of these areas have had soil surveys and the Director of Agriculture confirmed that it had been agreed that, before these areas were given over exclusively to forestry, soil surveys should be done so that their agricultural potential could be assessed. F.A.O. has promised to look into this and they may provide staff for soil surveys.

Bintulu-Miri-Long Lama Project:

- (1) This is an area of 2-4 million acres in the 4th Division where a request has been put up for a feasibility study on the lines of the South East Johore study. The E.P.U. were not satisfied with the initial project proposals and some of its staff were due to visit Sarawak in mid-May to revise these proposals into a form more suitable for Sarawak's special conditions.
- (11) Initially the Asian Development Bank was approached to do this study but turned it down on the grounds that it was not appropriate for their programme. There was a suggestion that the Australian government would be prepared to help, but they do not have the required expertise to do the full project though they could do parts of it.
- (111) I am not sure whether a feasibility study is required in the immediate future though undoubtedly such a study will be needed eventually to bring together all the information into a workable development plan. My doubts arise because I am not certain how much basic data on such items as land tenure is available (a reconnaissance soil survey has been done). The area has been chosen partly because land tenure problems are less serious than elsewhere since customary land tenure is a major obstacle to intensive land development in Sarawak. Nevertheless collection of adequate information and organization of a policy on land tenure may take several years whereas soils data could be got together relatively quickly. It is this difference in time for collecting different types of information which provides much of the imbalance in feasibility studies. Some types of information collection require a minimum time; extreme examples are soils data which, given a large team, can be gathered very quickly and hydrological data which takes at least 10 years to collect, i.e., some aspects are time dependent, others are not. For this project it might be more economical for O.D.A. to provide some of the data by its own teams rather than hire consultants to do so.
- (1V) New photographic coverage for any area can be done provided the Lands and Survey Department is given adequate notice. Not much help in the way of trained assistants can be given at present and the transport vote is not large.

4. Ad hoc surveys and surveys of development projects:

- (1) Two soil surveyors, one an expatriate, the other a Sarawak citizen, are employed nearly full time on these surveys, and attempts are being made to recruit a third soil surveyor for this work. If no Malaysian citizen is available then an expatriate would be recruited.

5. Forestry soil surveys:

- (1) The Department of Forestry employs one soil surveyor to do soil surveys on forestry plots. A large number of plots have been selected on a variety of soils, many of them thought to have defective forest, mostly hollow trunks, and the objective of this work is to find if these timber deficiencies can be linked to soil factors. At each site several soil pits are recorded and sufficient samples are taken so that the range in chemical characteristics can be measured. The soil surveyor has also been collaborating with R. Webster at Oxford and has taken a series of samples on a closely spaced grid so that a statistical analysis of variability can be done. These samples have been taken on a fixed depth basis but this presents some problems which do not arise in projects of this nature in the U.K. This applies particularly to sampling depth; in the U.K. the 0-6 in. layer is relatively homogenous so that standard depth sampling is feasible but in forest soils the top inch or so is greatly different to the deeper soil and far more careful sampling is necessary.

B. SOIL RESEARCH AND AGRONOMY1. General

- (1) The Research Branch has a well set up organization with about 20 research officers under an Assistant Director (Research). There are agronomists for each of the major crops, soil surveyors, entomologists, plant pathologists and a plant breeder. There is no statistician and statistical help is needed. As a first step the Rothamsted statistician (R. Wimble) might be asked to visit for a few weeks to examine the research programmes and perhaps to give a few informal

seminars on experimentation. The research officers are very keen but they are short on experience, most being appointed within the past 2-3 years. They cannot leave for further training until they have been established in their posts and this includes passing a stiff Malay language examination. There may be a gap of 3-5 years between their graduation at first degree level and departure for post-graduate studies.

## 2. Pepper Research:

- (1) Pepper is a very important crop in Sarawak and has been grown traditionally by the Chinese who improve the fertility of the very poor soils by liberal use of organic manures, including prawn dust, but this is now becoming too expensive and chemical fertilizers are being used increasingly. Very heavy dressings are used, 5 lb of an NPK Mg mixture per vine, which with 600-700 vines per acre means that nearly  $1\frac{1}{2}$  tons/acre of fertilizers would be given. Furthermore, the fertilizer is concentrated in a band around the vine so that the actual dressing given to the treated soil, on a per acre basis, is considerably higher. The long term effect of such heavy dressings on the very poorly buffered soils needs close examination. Leaf analysis and leaf symptoms suggest manganese toxicity in some plants; manganese toxicity induced by heavy dressings of sulphate of ammonia or superphosphates has been recorded elsewhere on poorly buffered soils. The role of silica in preventing manganese toxicity should be investigated under these conditions.
- (11) The Assistant Director (Research) has had a very useful programme on leaf analysis of pepper both from factorial experiments and from farmers' plots where the yields and state of growth of the vines have been recorded. From this he has been able to set optimum levels of the major elements in the leaf lamina and leaf petiole. Although these values could obviously be refined by doing more analyses or fertilizer trials, I suggest that the return for this extra work might not be commensurate with the investment in time and money and that now it would be better to try out the present levels as an advisory tool. Leaf analysis has been developed as an advisory tool on rubber, oil palm and sugar but then mainly on an estate basis. Pepper is grown only by smallholders and ways must be found of transferring the information from leaf analysis to the farmer. I suggest that some

form of pilot project using a small number of farmers to start with would be the best way to get this going. This would pin-point the difficulties in using the technique and suggest ways of taking the next research steps.

- (111) With pepper the most pressing problem is still the footrot caused by Phytophthora palmivora. The causal organism has been isolated but control, whether by fumigation or breeding resistant varieties, has still a long way to go. Budding on resistant rootstocks has had some success but apparently after about the third year incompatibility appears and the vines then stop production.

### 3. Peat Research

- (1) The Forestry Department Research Officer (Dr R. Anderson) has done much survey work on the peat soils of Sarawak. He has developed techniques for sampling to great depth - peat may be as much as 80 feet deep in Sarawak - has taken depth traverses across the peat and sampled at intervals from the outer edge to the centre of the peat, has had  $C^{14}$  dating done on the peat and has thus been able to calculate the rate of accumulation. Chemical analysis has included both major and minor elements in the ash; most of these deep peats show less than 1% ash; calculations have been done on a weight basis not on a volume basis because bulk density in these peats is very difficult to measure though attempts to do so are now being made. There are differences in major and minor element content both with depth and with distance from the edge of the peat, the levels of both in the ash generally getting less. Levels of some trace elements, about 8-10 ppm in the ash towards the centre of the peat swamp are extremely low.
- (11) At Staph Peat Research Station about 6 miles from Kuching there are observation trials on varieties and fertilizer needs of a number of crops on deep peat. The peat in this area appears very similar to Malayan peat, so results from the two regions should be comparable. Crops include coffee, oil palm, pineapples, sugar cane, Vetiviera grass, tapioca, sweet potatoes and pepper. Iron deficiency is apparently very widespread, in contrast to Malaya where copper is more deficient. Iron sulphate sprays cure the very distinct chlorotic appearance of iron deficiency but I suggest that the commercial iron sulphate being used be analysed for copper since it might contain some as an impurity. Oil palms are growing well but are already beginning to lean over at 4 years old and sugar cane is very poor after the first ratoon. Some varieties from Guyana might be better but apparently Sarawak has had difficulty in importing these. Pineapple are growing quite well as would be

expected and there is a range of tapioca varieties under trial. A series of pipes between two drains measure the height of the water table, but the tops of these have not been levelled so that it is not possible to plot the water levels in relation to a datum point.

(111) Some strategic decisions on peat research in Sarawak will have to be made for deep peat covers about 13% of the total land area of Sarawak, but 60-80% of the flat land. It is in the more readily accessible areas, the useful timber (Ramin) is being rapidly worked out and there are few land tenure problems, being mainly State land. Peat is more important in terms of overall land utilization policy in Sarawak than it is in West Malaysia and Sabah. However, the E.P.U. report that utilization of peat soils in West Malaysia is also assuming considerable importance due to their proximity to centres of population pressure; much of the expansion in South West Johore is on to peat soils, forest on these is being cleared, some crops grown and then the area often abandoned.

(1V) Successful agricultural use of these soils will depend on solving a number of physical and chemical problems. The chief physical factors are drainage and the inability of tree crops to remain upright. Movement of water through the soils is very slow so that the draw-down even close to a large drain is small. A better technique of drainage might be to surround peat areas under cultivation with perimeter drains to exclude excess flood water and have frequent shallow drains to remove excess rain. It is doubtful if deep drainage can be done economically, but only by measuring the effects on water tables can adequate standards be set; a water management specialist is needed for work on peat soils. Drainage in Sarawak is likely to be even more important than in West Malaysia because the rainfall is that much greater (140-160 in. vis-à-vis 80-90 in. in agricultural areas of West Malaysia). In fact the 50-70% higher rainfall in Sarawak and parts of Sabah are very important considerations which tend to be neglected in the agricultural research programme when such programmes follow too closely those of West Malaysia.

(V) It is not certain what steps can be taken to keep trees, particularly oil palms upright. The normal forest on peat swamps remains upright even where the area is waterlogged so presumably they have a particularly

well adapted root system. Whether oil palms can be propped up in the same way as bananas could be investigated; the effect of spacing might also be investigated as closer spacing should give smaller crowns. There are many nutritional problems in peat soils requiring solution. Thus deficiency of copper is usually serious but treatment is complicated by the rapid fixation of certain levels and phytotoxicity when too much is added. Leaching of nutrients such as potash in the very high rainfall also requires examination. Though the ash of peat soils has some silica, peat soils must be very low overall in silica and the value of soluble silica on peat soils should be investigated.

#### Acid Sulphate Soils

- (1) Some of the flat land of Sarawak not covered by peat is in the estuarine areas where acid sulphate soils are mostly located. One such area on the Sungei Sarawak has been surveyed in detail and a considerable proportion of this found to have potentially high acidity. Advice on the use of this area has been conflicting, the local Department of Agriculture suggesting postponing development whilst the Department of Agriculture in Kuala Lumpur state that adequate drainage and leaching with liming will overcome these problems in a relatively short time. However, lime is very expensive in Sarawak as it has to be imported from West Malaysia, and there is no evidence from experience elsewhere that leaching will dispose of the sulphates quickly.
- (11) The Santubong drainage scheme and the Rampangi acid sulphate soil station are near Kuching. The drainage scheme is designed to drain an area of Nipah palm swamp and provide 2000 acres for coconuts, 10 acres per settler. Seed nuts are provided but the settler has to clear, plant and provide field drains; clearing Nipah palm is arduous work and it regenerates easily. I am not familiar with any areas in West Malaysia which were cleared directly out of Nipah palm for agriculture.
- (111) There are pyrite deposits in some of these soils so drainage will generate considerable acidity likely to affect coconuts seriously. Padi planting has been done on the Rampangi station but, in the absence of a reliable supply of good irrigation water, short droughts in the middle of the monsoon season can ruin the crop and make it impossible to do dry season cropping with any certainty. Until the station gets an assured supply of good quality water there seems little point in undertaking a comprehensive experimental programme. It would be

advisable to stick to very simple observation trials to see just how well crops could be grown. The utilization of acid sulphate soils presents difficult problems in both East and West Malaysia and these are discussed in detail in my West Malaysia report.

#### 5. Illipe Nut:

- (1) The Sarawak government has forwarded a request for a research programme on this important crop but this has not got beyond the Economic Planning Unit in Kuala Lumpur. Apparently the tree flowers and fruits irregularly at intervals of 4 or 5 years; when it does so the crop is worth about M\$ 15 million, the oil being highly desirable for chocolate manufacture because of its high melting point and for cosmetics. Several species of Shorea are involved, the most useful being macrophylla. The Forest Department has a collection of the different species in a plot about 12 miles from Kuching. Apart from some investigation by the T.P.I. on the oil, so little work has been done on the crop that the problems are ill-defined and it is not certain what sort of expert would be required, possibly a botanist to study the physiology of the crop and perhaps to examine the effects of stimulants on flowering. Java is said to have varieties that flower and fruit annually but attempts to grow these have failed.

#### 6. Soil suitability and land capability:

- (1) The soil suitability classification introduced in West Malaysia is being tried out in Sarawak. This divides the soils into 5 classes which are basically economic classifications ranging from Class 1 - land with few or no limitations, to Class 5 - land with serious limitations. The problem of this classification is its assumption that Class 11 land, e.g., the deep podzols, with only one limitation, nutrient deficiency, can be used provided that limitation is removed; however, no proven economic management system exists for the utilization of these soils. The same applies to peat soils for though these can be put in Class 111 on the basis of their poor drainage characteristics, there is little information on their management either from the drainage or the nutritional point of view.

- (11) A further problem arises over the scale of the mapping. Soil suitability classifications are intended to put soil series into 'boxes' and soil maps at about 1:50,000 scale are required. Sarawak has been mapping not at the series, but only at the family level and the family may cover a considerable depth range, for example, which would put the soils into several soil suitability classes. A lot depends, of course, on the ultimate use of the soil suitability maps, but as a general indication of the soil potential of Sarawak much more general maps only are required indicating swamp soils with and without peat and soils of sedimentary origin on different slopes.

7. Soil analysis:

- (1) Present soil analysis techniques do not take into account the high acidity of Sarawak soils and exchangeable aluminium should be determined on these soils. Other soil analysis techniques appear adequate but determination of silica in the ash of the peat samples might be interesting.

8. Acknowledgment:

I am very grateful to Dr R. Anderson, Mr Ian Baillie, Mr Sim Eng Shiong and Mr B. Balbernie for many helpful discussions during my visit.