COMMONWEALTH DEVELOPMENT CORPORATION

SARAWAK OIL PALMS SDN BHD

VA REPORT No 9

by

L.J.FOSTER
Senior Agriculturalist

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LONDON W1A 3AR
England

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Visited	- 12th to 19th September 1978
Last Visited	- 25th February to 4th March 1978
Period Reviewed	- 1st January to 31st July 1978
Financial Year Ends	- 31st December

October 1978

Co-ord Ops 2048/302 25th October, 1978

SOP - VA's REPORT

Mr L.J. Foster has just reported on his VA visit to SOP in September. Since SOP is, and will for the foreseeable future remain, a project causing concern with a larger CDC investment than any other such listed project, you may like to see the attached summary of his report.

2 This rightly highlights labour shortage as still remaining the key issue. To supplement the summary -

(1) 622 labourers were engaged in the eight months to end August and 587 resigned - turnover continues very high;

(2) field labour force is 38% below strength;

(3) the Indonesian Consul at Kota Kinabalu has increased his fee per labourer recruited from M$90 to M$240, so that cost of recruitment per Indonesian labourer per year inclusive of return air fare is M$510 - a heavy additional burden.

3 The second imponderable remains the future evacuation of oil, the four alternatives appearing to be -

(a) transport to Bintulu by road, for which an estimate would be required for a fleet of about 7 tankers and their running costs;

(b) transport to Bintulu by barge, for which a comparative estimate would be required for two barges and one tug and operating costs;

(c) acquire existing Piasau facilities for SOP to operate, in which case SOP would have to rely on small 1,000 tonne tankers calling at Miri;

(d) instal new facilities on the Sibuti River near Bekenu.

.../2

Mr Foster points out that whichever course is chosen it will involve SOP in heavy additional costs.

4 On the credit side, the 30% export duty concession announced in last week's budget will be of considerable help.

R.A. DUNCAN
Senior Operations Executive

RAD/AKW

cc Agr A
Mar O
H Eng

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S.2 - Labour Situation

1) The local labour situation is not likely to improve because of the increased tempo of development going on in, and around Miri and also in Bintulu where work on the proposed new deep water port will initially require a large number of unskilled workers. The Estate, therefore, will have to depend more and more on immigrant workers.

2) With the decrease in crop harvesting rounds in all areas have reduced. A nucleus pruning gang was formed in 1969/70 areas, and it is hoped that this will help to reduce the pruning backlog.

3) The introduction of an incentive scheme for drivers, has resulted in an improvement in the amount of FFB collected per vehicle. Improved earnings will also encourage drivers to continue employment on the estate. Except for bad weather and vehicle break-downs, delayed collection of FFB has been minimised.

4) Crop is now decreasing and we may be some 2000 tonnes short of 51,800 tonnes estimate.

5) We are still very short of pollinators, and the scheduled 8 rounds per month are not being carried out in all areas.

6) General weeding standards are considered reasonable in the 1969/70, 1971 and 1972 areas. Fertilizers applications, particularly in young palms areas, are only done after completion of circles spraying rounds, thus competition from weeds for fertilizers is minimal.

7) At the time of V.A.'s visit the major part of the 'Maintained' areas of 1974 planting are in reasonable condition. The only backlog on weeding rounds was in F16, which was due for upkeep in September (its last round done was in April). Other areas were, of course, temporarily abandoned, due to the limited available labour. Similarly, in the 1973 plantings, the 'maintained' areas are in reasonable condition, except, E3, E10, E11 and E12.

SUMMARY

S.1 General

The financial period 1st January to 31st July 1978 is reviewed and some comments refer to activities to mid-September. The writer wishes to take this opportunity to thank Mr and Mrs J.H.M.Walton for their very kind hospitality. Acknowledgement is also made to Mr Lim Fook Hin for kindly compiling Appendix 2.

S.2 Labour Situation

(1) The labour position is as bad as ever and has generally been worse during the period under review than in 1977. Management is faced with the impossible task of trying to operate an estate on 72% labour strength, another 300 workers being required to carry out all essential operations.

(2) Harvesting rounds are too infrequent and there is a loss of loose fruits in the field. The extraordinarily heavy rains experienced recently at SOP and apparently throughout south-east Asia, have further made harvesting and collection very difficult. Pruning and sanitation rounds have been omitted almost entirely this year and in some mature areas have not been completed since January 1977. The lodging of loose fruits in the axils of fronds and the high incidence of rat damage in some areas has led to a further loss of crop.

(3) In addition to the general shortage of labour, the estate is suffering from competition with the timber contractors who are now able to pay very high wage rates. Three of the best drivers have recently been lost and the crop is being collected slowly; harvested bunches have to lie in the field for up to three days and sometimes longer. As a result of infrequent harvesting rounds and delayed collections, free fatty acid has risen in processing (3% to 4%), but the extraction rate is good ($\pm$ 20%).

(4) The general impression is that the estimated crop will be achieved by the end of the year with difficulty and only if the expected new recruits arrive from Indonesia. Furthermore, that crop could have been much greater if it had been possible to have brought fully into bearing the 1973 and 1974 plantings, only parts of which are at the moment being cropped. This latter factor is a significant one in adversely affecting the project's financial rate of return.

(5) Pollinating rounds have been quite inadequate during the period under review and, as most pollinators are at the time of writing busy planting their padi, there will be a significant reduction in potential yield in the younger plantings in six months' time and the problem of bunch rot is likely to recur.

(6) General weeding standards are poor, except in the 1969 and 1970 plantings where there is a closed canopy, and the recovery of loose fruits is difficult. Furthermore, heavy weed growth competes with the young palms for fertiliser applications.

S.3 - Policy for the Immediate Future

1) Although there is every likelihood that more labour will be available through our present source of supply, other avenues need to be explored to ensure a constant and reliable supply of immigrant labour. We have now submitted our application form to the Indonesian Government through our CDC Office in Jakarta, to recruit Javanese workers, and await the outcome.

2) The remaining part of the 1974 planting will be maintained as and when labour is available.

3) V.A.'s comments are noted.

4) The present fleet of transport consist mostly of old vehicles, and considering the conditions under which they operate, the performance achieved is considered reasonable. With the purchase of two new lorries as replacement next year, the situation will definitely improve.

5) No comment.

6) V.A.'s recommendation noted and will be looked into.

(7) The standard of maintenance and upkeep is now reaching or has already reached in some areas, particularly the 1973 and 1974 plantings, an unacceptable level and crop estimates for 1979 will reflect these low standards.

S.3 Policy for the Immediate Future

(1) There is little hope of improving the labour situation by the recruitment of local labour. It just does not exist. Furthermore, local workers are extremely unreliable and temperamental and there is a very high turnover. Over 30% of the labour force is recruited from Indonesia and this should be increased to 50% if the labour force is to be at the required strength. The only source at present is through the Indonesian Consul in Kota Kinabalu who has recently much increased his price. However, this higher payment has resulted in promises of labour and the first 14 recruits were expected on 20th September. It remains to be seen whether the supply of labour will be continuous and can reach the required level or will merely be sufficient to top up losses in the presently inadequate force which is engaged on a yearly basis. This labour source depends entirely on the goodwill of the local Consul and the situation could change every time the present incumbent is transferred. The recruitment of labour from across the border (in Kalimantan) does not appear to be favoured by the Sarawak Government (SG). A proposal to recruit labour from Java has yet to be investigated and requires the assistance of Representative Indonesia. It may be possible to recruit families for a long term, say, five years, on a guarantee of adequate housing. This may mean building additional housing.

(2) The remaining part of the 1974 planting is and should be maintained as and when labour is available and there is nothing better that management can do.

(3) In view of the present condition of the plantations, management has been forced to estimate for only a modest increase in crop for 1979 (57,450 tonnes compared with 51,800 tonnes for 1978, a figure with which I have agreed), this estimate being attainable only on the assumption that the labour situation improves. On this basis, the processing requirements for the 20-tonnes per hour mill is unlikely to exceed the capacity of a one-shift system with overtime; staff and labour for a second shift would not have to be recruited. There are already two trainee engineers, one of which is surplus to immediate requirements.

(4) The transport situation is poor. Additional expenditure is essential in 1979 for two lorries for fresh fruit bunch (FFB) collection and replacements are required in staff transport.

(5) Overheads are being and can be further reduced by employing two in place of five expatriates.

(6) As suggested in the last report (paragraph 12.01), it is intended to bring E2 (64 ha) of the 1973 planting under first class maintenance. It is also recommended that a similar area in the 1974 planting be so treated.

S.4 - Longer Term Policy

1) Points noted.

2) The 1976 and 1977 planting will be fully maintained, subject to labour being available.

S.5 - Export Duty

1) Both Sabah and Sarawak have been given the benefit of a 30% reduction in export duty. This while undoubtedly helpful, will not solve SOP's financial problems, and further appeals should be made for total exemption from export duty for at least 10 years.

S.4 Longer Term Policy

(1) On a longer term basis, Secretary/Accountant has shown (see Appendix 2) that if the marginal areas of 288 ha of the 1974 planting are abandoned, the break-even point for the whole estate is 16.9 tonnes per ha, ie the estate must produce a crop of 63,300 tonnes. If the low-yielding area is included, the break-even point for the whole estate reduces to 16.4 tonnes per ha, but the tonnage required will be 66,200 tonnes FFB. The low-yielding area comprises 6.7% of the estate and taking the Agricultural Research and Advisory Bureau (ARAB) assumption of 8.3 tonnes FFB per ha means that the remaining area will have to yield proportionately higher, ie at least 17.0 tonnes FFB per ha. Assuming Marketing Officer's price estimates for palm products for 1979 and charging only direct fixed and variable costs, then it would be worth harvesting the marginal areas of the 1974 planting if the yield exceeded 7.9 tonnes FFB per ha (3.2 tonnes per acre). This could be attained on ARAB's estimate, which is 8.3 tonnes per ha and which I agree with Project Manager is conservative, 9.8 tonnes per ha is more likely to be achieved. The limiting factor here is, therefore, labour and its availability. The long-term estimates show when the required break-even yields can be achieved by the 1969-1973 areas, but on present labour availability these dates will have to be delayed significantly.

(2) The 1976 and 1977 plantings should, of course, be fully maintained.

S.5 Export Duty

A further crucial factor affecting the financial viability of the estate, particularly while yields are low in young plantations, is that of export duty. When CDC was invited by SG to initiate an agricultural project, SG expected that this pioneer development would only be a forerunner to other similar operations and, no doubt, SOP's progress has been watched closely by commercial organisations interested in promoting plantation agriculture. However, although potential yields are reasonable, there has been little to encourage any further development and the imposition of a discriminatory export tax on the only commercial agricultural project in Sarawak suggests that commercial agriculture is not to be encouraged in Sarawak. It would be a gesture of goodwill if -

(a) equal facilities as to export duty could be extended to SOP as to SG's wholly-owned oil palm enterprise; and

(b) a more positive encouragement was given to the recruitment of immigrant labour.

These concessions would enable SOP to continue operations and would help to boost the morale of staff and skilled labour who are unsettled because of the uncertainty of their careers.

SARAWAK OIL PALMS SDN BHD (SOP)

VA REPORT No 9

(M$4.48 = Stg £1)

1 Area Statement

1.01 The planted area has not changed since the last visit and is summarised in Table 1.

Table 1

Area Statement

	Hectares	%age of Planted Areas
Mature Areas (1969 to 1973 plantings)	3,134.0	75.6
Immature Areas (1974, 1976 and 1977)	1,009.7	24.4
Total planted area	4,143.7	100.0
Old nursery site (for airstrip and effluent pond)	13.6	
Building sites, mill and roads	41.9	
Reserves	283.9	
Total area	4,483.1	
Less areas not under title	2,167.1	
Total area under title	2,316.0	

1.02 Although parts of the 1974 plantings are now being harvested, these will not be included in the mature areas until 1979. An adjustment has been made to the area not under title as a result of the survey of the 1973 area in November 1977 but the Survey Department has not yet issued the land title.

1.03 Map 1 at Appendix 1 is virtually unchanged.

1.04 Of the reserves, 31.8 ha are unplanted at the southern end of C4, D1 and D2 across the River Satap which now forms a natural boundary to plantings at the south-western corner of the estate. The remaining 252.1 ha are on steeply broken land to the north-eastern boundary.

2) Staff

2.01 Senior Staff

The Field Manager (FM) is K. Gehrig.

2.02 Junior Staff

Mr. Empaling Ukoh is one of the two field conductors that resigned. Mr. C.V. Bhaskaran is in the Super Grade Scale.

2 Staff

2.01 Senior Staff

The senior staff position for the period under review is given in Table 2 below.

Table 2

Senior Staff Position

Designation	Name
Project Manager (PM)	Mr J.H.M.Walton
Secretary/Accountant	Mr J.D.Foley
Field Manager (FM)	Mr K.J.Gehrig
Mill Manager	Mr P.H.Dunk
Senior Field Assistant	Mr M.S.K.Ali
Field Assistant	Mr H.Awell
Agricultural Trainee	Mr W.Bulmer
Mill Engineer	Mr Wong Ngie Yong

Mr Foley left on 7th August 1978 and was replaced by Mr Lim Fook Hin wef 1st August 1978 after a 1½-month handing over period.

2.02 Junior Staff

(1) The junior staff position is given at Table 3 on page 3. The area of supervision per field staff member remains at 207 planted ha; including senior staff it becomes 1:166.

(2) The work permit for Mr Pereira, an Indian expatriate, expires at the end of November 1978. Two field conductors, Messrs Empaling Ubok and Wesley Wong have resigned and will not be replaced as one or more of the Agricultural Cadets will be selected as Field Assistants after July 1979 when they will have completed their three years' service and will be eligible for their estate practice examinations.

(3) Two trainee engineers were engaged in the mill in March.

(4) Other minor changes have been in the positions of Harvesting Checkroll Clerk, Clerk/Typist, Accounts Clerk and Workshop Superintendent (all replaced) and Engineering Cadet and Factory Foreman (both resigned) the latter to be replaced in mid-September. One Accounts Clerk has been promoted to Chief Clerk.

Table 3

Junior Staff Position as at 31st July 1978

Designation	Name	Grade
Field Conductor	Mr T.G.Pereira	Super
Field Conductor	Mr C.V.Bhaskaran	~~Special~~ Super
Field Conductor	Mr Lew Sam Chong	1
Field Conductor	Mr James Emba	1
Field Conductor	Mr Morris Changgai	2
Field Conductor	Mr Song Tieng Sing	2
Field Conductor	Mr John Umong	3
Field Conductor	Mr Ahmad Shahdi	3
Field Conductor	Mr David Masing	3
Field Conductor	Mr Ong Ai Kiong	3
Field Conductor	Mr Protolum Umbat	3
Field Conductor	Mr Dunstain Endawie	3
Field Conductor	Mr Andrew Ullin	3
Field Conductor	Mr Pau ak Wan	3
Agricultural Cadet	Mr Mok Ing Hua	-
Agricultural Cadet	Mr Raymond Tan	-
Agricultural Cadet	Mr Dennis Chang	-
Agricultural Cadet	Mr Simon Manyus	-
Agricultural Cadet	Mr Pang Seng Nam	-
Trainee Engineer	Mr Lee Ting Kui	-
Trainee Engineer	Mr Wong Tung Ming	-
Surveyor	Mr Idris Wayne	Super
Harvesting Checkroll Clerk	Mrs Ong Siew Hui	-
Laboratory Technician	Mr Rawing Bugat	2
Factory Clerk	Mr Richard Wong Tien Ting	3
Factory Supervisor	Mr Dennis Yap	Special
Workshop Superintendent	Mr Chieng Kai Soon	Special
Stores Controller	Mr Lawrence Lee	1
Stores Assistant	Miss Yeo Siaw Cheng	3
Chief Clerk	Miss Sim Yean	1
Clerk/Typist	Miss Goh Na Nee	3
Accounts Clerk	Mr Nelson Badon	3
Accounts Clerk	Mr Ugus Maga	3
Accounts Clerk	Mrs Song Ting Sing	3
Accounts Clerk	Miss Law Siok Bee	-

3) Labour

The labour position slightly improved after the V.A.'s visit. 35 immigrant workers arrived on the Estate in September (15 of these are Timorese, and others, Bugis) and 9 left employment. The Indonesian Consul/promised that more workers will arrive /has by the end of the year.

3.03 Several of the newly recruited drivers replacing the ones we lost, appear to be promising, and we hope to be able to retain them with the recent introduction of attractive incentive payments for FFB transport.

3.04 Harvesting rates in 1974 areas will have to be maintained at $13.00 per tonne, until the crops in the area improve and harvesters' average earning become comparable with those in other areas.

640 labourers on strike 2.1.79

80% returned 26/1/79

3 Labour

3.01 The labour position is as bad as it was at the beginning of the year, the total labour force being about 742, reaching a peak of 816 in March. Turnover has been very high; 622 labourers were engaged in the eight months to the end of August and 587 resigned. Labour out-turn has been poor, on the average 86.6% attendance for checkroll labour. On the basis of one labourer to 4 ha, the field strength for 4,143 ha should be 1,036, and at 742 is, therefore, 38% below strength. The composition of the labour force is -

	Number	%age
Checkroll - bugis (Indonesian)	225	30
- others (Sarawakians)	416	56
Contractors (mostly Sarawakians)	101	14
	742	100

The estate is, therefore, considerably more dependent upon immigrant Indonesian labour than at the last visit, when they composed 20% of the labour force. At full strength, Indonesian labour is likely to compose 50% of the labour force.

3.02 No further immigrants have been obtained since the arrivals reported at the last visit and the Indonesian Consul at Kota Kinabalu has demanded an increase in his fee from M$90 to M$240. The cost of recruitment is now as follows -

	M$
Payment to Consul	240
Air fare	120
Medical examination	20
Contract stamp	10
	390
Return air fare at end of year's contract	120
	510

Perhaps half of the Indonesians stay on for a further period, usually up to one year, and the cost of recruitment, therefore, is equivalent to paying a 13th month or more in wages.

3.03 The estate is also suffering from competition with timber contractors. Three crop loading drivers have been lost to timber companies and, although new drivers are being trained, this means a loss of loading capacity for two to three months at a time when a heavy crop is in the field.

3.04 The cost of labour has not changed significantly. Harvesters are earning more (M$12.79), which is nearer the figure (M$12.84) they were earning a year ago, but this is because they could not be spared for pruning.

Harvesting daily rates were M$13.00 per tonne fresh fruit bunch (FFB) for the 1973 and 1974 areas, but wef 1st July 1978 the rate all over the estate will be M$12.00 per tonne. Although the young plants yield less, chisel harvesting is more popular than the use of sickles in the taller palms and I agree with management that there is no justification for paying a higher rate for the younger palms.

4 General Charges

Expenditure - M$1.53m = M$370 per planted ha
Estimate - M$2.64m = M$636 per planted ha

There was no significant variance and there might be a slight saving in salaries.

5 Upkeep Buildings and Compounds

	Expenditure M$	Estimate M$
Staff housing	43,267	65,000
Water and power	52,049	60,000
Artisans' quarters and labour houses	22,172	40,000
Water and power	2,464	5,000
	119,952	170,000
Cost per planted ha	29	41

5.01 The estimate for water and power to staff housing will be exceeded as the old piping which was to be used for supplying water was too rusted and new piping had to be purchased.

5.02 No new labour houses have been built and 385 units out of 390 are available, the remaining now being used as auxiliary police station, shophouses (2), creche (SADC unit), mail van driver and for pump-house attendant at the Luak River. The present labour occupancy is 1.9 workers per unit. Six units are vacant and there is enough accommodation for about 200 additional workers on the assumption that most new recruits will arrive as bachelors. The estimates for 1978 contain four double and one single labour units but construction will rightly be deferred until labour is in sight. It may be necessary to build additional housing for labour if families can be brought in on long-term contracts from Java.

5.03 One senior staff quarter has been built for the Factory Workshop Superintendent and three artisan staff quarters have been completed. The extension to the stores is in progress after which it is intended to start improvements to the Staff Club.

5.04 The culvert under the main road has not yet been deepened by the Public Works Department (PWD) and part of the labour compound is still subject to flooding.

6) Medical and Welfare

6.01 Medical examinations of newly recruited immigrant workers are required by the Labour Department for the attestation of the Labour Contract Agreement.

7) Upkeep Mature Areas

7.01 - Weeding

1) Control of woody growth by wiping with 2,4,5-T could only be done more frequently if labour is available. Control of casava has been the subject of two letters from Agriculture Department recently, resulting in the final recommendation from May & Baker to use 2,4-D Amine. This of course has been extensively used in the past, with little or no effect. V.A.'s points on central harvesting lanes in 1973 areas are noted, however much of the area is now on the palm to palm system and I would not recommend a change at this stage.

2) No comments.

3) See comments on Pruning.

6 Medical and Welfare

Expenditure - M$ 73,223 = M$18 per ha
Estimate - M$105,000 = M$25 per ha

6.01 There were 18 hospital cases during the period and seven maternity cases.

6.02 The cost includes medical examinations of 118 newly recruited Indonesian immigrant workers which was not included in the estimate. There will, therefore, be some over-expenditure.

7 Upkeep Mature Areas - 3,134 ha

This area includes 113 ha of the 1973 planting which have not yet been brought into cropping as they are difficult to maintain. Of the 1973 planting 64 ha (E2) are being given the full maintenance treatment as estimated and as suggested in my last report; in due course the effect upon yield will be noted.

7.01 Weeding

Expenditure - M$125,799 = M$40 per mature ha
Estimate - M$275,412 = M$88 per mature ha

(1) Where the canopy is complete, espcially in the 1969, 1970 and parts of 1971 areas, the weed conditions are satisfactory. Some woody growths require control and wiping with 2,4,5-T needs to be done more frequently. However, generally weed control is at an unacceptable level and this, of course, is a direct result of the shortage of labour. The above figures show a 12% under-expenditure and the estimate itself has been reduced by 20% compared with that for 1977. If all that is necessary is done, there would be significant over-expenditure because there is a backlog of weeds accruing from last year. About half of the total expenditure went on the 1973 planting where one round of slashing was very costly because of the difficult conditions. For spraying circles and paths MSMA formulations with sodium chlorate are used because, although not quite as effective as MSMA/Paracol (see the last report), they are cheaper. Spraying rounds have been too infrequent, eg after five months instead of quarterly in D13 of the 1972 plantings. Lalang is generally under control but Eupatorium is completely out of control in the 1973 plantings, as there has been no follow up to initial spraying rounds with 2,4-D amine. In D12 and D13 and one or two other fields, small areas of cassava have proved difficult to control. Glyphosate (Roundup) could be tried. Iocynil might also be tried as a spot spray as it will penetrate slowly to the root system, but care must be taken to ensure that it is not sprayed on the palms. In the 1973 areas, the plant rows have been sprayed for harvesting paths; but it is difficult to walk along them as the fronds are still low and the normal practice of spraying circles leading to a central harvesting lane down every other inter-row is preferable.

(2) The herbicidal trial recommended at paragraph 7.01(4) of the last report was not carried out because of the difficulty of obtaining further supplies of chemicals and the labour shortage.

(3) Palm base and trunk sanitation has had to be almost entirely neglected this year and there are many seedlings to be removed at the base of the palms (see also paragraph 7.09).

7.02 - Pests and Diseases Control

1) Pest detection survey is carried out in all planted areas, more frequently in the maintained areas and alternate monthly in the unmaintained areas.

2) If the absence of dead rats in the treated fields is any indication Ratilan (Coumachlor) did not prove as effective as Buah Emas (Warfarin).

7.03 - Manuring

Several more errors in the fertilizers formulation were noted from random samples taken from both the stores and in the field. Strong complaints already been made to Guthries and their reply is awaited.

7.02 Pest and Disease Control

Expenditure - M$ 13,927 = M$ 4 per mature ha
Estimate - M$101,075 = M$32 per mature ha

(1) There have been no serious outbreaks of leaf pests. A total of about 150 ha in the 1971 plantings were treated with lead arsenate as spot sprays in C6-11 to control the nettle caterpillar, Thosea asigna, and minor outbreaks of bagworms. Regular inspections continue and are evidently well worth the cost.

(2) More recently severe rat damage was noticed in June/July, the immature fruits being attacked. This is the first time that rats have posed a problem at SOP. Baiting has started in the 1969 and 1970 areas with Ratilan, which contains coumachlor, and is still required in the 1971 and 1972 areas. The damage appears to be caused by small field rats and is widespread in the fields. It is possible that their presence has been encouraged by the low standard of pruning and weeding.

(3) On diseases, the incidence of bunch rot is about the same or rather less than at the last visit. The importance of assisted pollination is discussed in paragraph 7.08 below.

(4) Although this section deals with the mature areas, it is important to ensure that the pest detection team has spare capacity to inspect all areas on the estate planted to oil palms.

7.03 Manuring

Expenditure - M$ 531,237 = M$170 per mature ha
Estimate - M$1,108,968 = M$354 per mature ha

(1) The 1978 expenditure includes M$91,051 for fertiliser applications in January in the 1969-1972 areas brought forward from the 1977 fertilising programme.

(2) The estate as a whole is now following the recommendations of Dr Guha's organisation, the Agricultural Research and Advisory Bureau (ARAB), but the first two applications were combined using the old stock of straight fertilisers. The four fertiliser mixtures (see paragraph 7.03(3) of the last report) have now been formulated and received. However, the contractor (Guthries) has made at least one error in the formulations. At least 25 tonnes have been incorrectly mixed. These mixtures are being applied as third and fourth dressings in the second half of this year, the third application being applied at the time of the visit.

(3) Although expenditure is at the moment well within estimate, this item is likely to be overspent as the mixtures are more expensive than the straights. There will, however, be a saving in labour.

(4) There will also be a small saving in potash fertiliser as bunch ash will be used in place of muriate of potash with a nitrogenous fertiliser in some of those fields where phosphorus is not required.

(5) The calibration plots in C2 and C3 (1971 planting) continue to show no response to fertiliser, the mean yields per plot for the period being as follows -

7.04 - Roads & Bridges

1) A new gravel supplier, Hollystone Quarry have undertaken to supply 7,500 cu yds up to the end of the year, at a cost of $32/cu yd.

2) If Hollystone Quarry can fulfill their contract, it is possible to complete the initial gravelling of roads in the 1973 plantings, within this year.

3) Work on harvester's footbridges is continuing.

Treatment	Mean Weight FFB (kg)	Total Rotten Bunches
Nil	2,506	39
0.5R	2,629	27
1.0R	2,482	31
1.5R	2,674	26
2.0R	2,559	25

The incidence of rotten bunches was greatest in the unfertilised plots which might give some credence to the theory that fruit set is a factor of manurial levels. However, most of the bunch rot and the lowest yields in the Nil and 1.0R levels, occurred in two adjacent plots in C3 and some other factor would appear to be responsible; if these plots are disregarded, the nil plots are the highest yielding. The 20 calibration plots are now to be discontinued and ARAB have drawn up a design for a fertiliser trial to commence in 1979 (see Appendix 3) after 12 months of calibration so that a correlation coefficient can be worked out. This will be a $3^2 \times 3$ design, one replicate to be at SOP (27 plots over C2 and C3) and the other at SLDB. There will, in addition, be eight observation plots to include additional treatments with triple superphosphate in place of rock phosphate (three plots), boron, ammonium chloride and urea in place of sulphate of ammonia (two plots) and kieserite as magnesium deficiency is common along the roadside. The eighth plot will contine the standard recommendation for the field based on soil and leaf sampling.

7.04 Roads and Bridges

Expenditure - M$144,589 = M$ 46 per mature ha
Estimate - M$579,598 = M$185 per mature ha

(1) The shortage of labour and of gravel has meant that maintenance is at a minimum and that during heavy rains, at the time of the visit, tractors were getting stuck.

(2) The initial road gravelling in the 1973 area (6.8 km) has not yet been completed, although some roads have been made just passable by the use of kernel shell. There will still be another 500 chains to be done in 1979. Crushed stones are again in short supply, 453 loads being received against an annual requirement of 2,000 loads. An alternative source is being sought; a possibility is from Marudi to Miri by barge, thence by road to SOP. This would cost about M$32 per cu yd compared with the present price of M$22.50. There are about 175 km of estate roads to maintain.

(3) Harvesters' footbridges and steps have been put in the 1970 areas and a good job has been made with footbridges across the river in E10 of the 1973 planting. This work still has to continue in E1.

(4) A total of 56 new culverts were constructed, mainly on the 1971-1973 areas, where wooden bridges are being replaced.

7.05 - Drains and Water Gates

No comments

7.06 - Platforms

Work on construction of new FFB platforms resumed in 1973/74 areas and upkeep of existing ones undertaken in 1969/70 and 1971/72 areas.

7.07 (2) V.A.'s points noted.

7.08 - Assisted Pollination

1) Pollination rounds have improved since V.A.'s visit except in the 1969/70 and parts of 1972 and 1973 areas. Every effort is made to recruit additional pollinators.

4) Pollen stocks have now increased substantially, but problems have been encountered on storage as the second deep freezer has not yet arrived.

7.05 Drains and Water Gates

Expenditure - M$10,339 = M$ 3 per mature ha
Estimate - M$40,031 = M$13 per mature ha

Most of the work was done in the 1970 and 1973 areas. Scheduled work could not be done due to shortage of labour.

7.06 Platforms

Expenditure - M$ 4,328 = M$1.4 per mature ha
Estimate - M$14,273 = M$4.6 per mature ha

New platforms have been constructed in part of the 1973 planting with E3 (113 ha) outstanding. Harvesting platforms have been cleared in the 1970-1972 areas. Labour problems have necessitated the minimum of work being done on this item and in many cases platforms are inadequate.

7.07 Survey, Census and Supplying

Expenditure - M$ 8,329 = M$2.7 per mature ha
Estimate - M$13,260 = M$4.2 per mature ha

(1) M$5,593 were spent on supplying, mainly in the 1973 planting (2,887 palms), but also along the roadsides where there were no palms in the 1969-1972 areas. An additional area of E7 was planted up with 1,546 palms; this area had been disputed with a local longhouse but the opportunity arose to plant to the river boundary when no crops were planted this year.

(2) In some areas palms need renumbering. A few extra field markers are required particularly at road junctions; in the 1973 area the leaf sampling sections are shown on the field labels and this would be useful if done in the other plantings.

7.08 Assisted Pollination

Expenditure - M$215,069 = M$ 69 per mature ha
Estimate - M$387,204 = M$124 per mature ha

(1) As on the previous visit, most plantings were under-pollinated due to pollinators being under strength. The target is eight rounds per month, ie 56 rounds for the period under review. Plantings were pollinated during the period under review as follows - 1969 (46), 1970 (55), 1971 (51), 1972 (47) and 1973 (42). Random sampling of bunches at the mill in July and August showed some high percentages of poorly pollinated bunches, particularly in the 1972 plantings. Bunch rot was seen in E1 of the 1973 area as a result of poor pollination five to six months ago. The 1972 and 1973 plantings need more attention, very difficult at the moment as women are away planting rice. The crop in six months' time will suffer.

(2) The pollination trial in Field A7 (13 ha) was reviewed in the last report (see paragraph 7.08(3)), where a slight response was noted to the higher pollination level. It will be recalled that Plot A was at 100% pollination (every row pollinated eight rounds per month) from

July 1976 to July 1977, and Plot B was at 50% pollination (every other row pollinated, the rows being changed over every month). After 12 months the treatments were changed over and all pollination ceased on 31st December 1977. Adjusting yields on a per palm basis, the results on FFB are summarised in Table 4.

Table 4

Pollination Trial

Treatments	Plot A		Plot B		Ratio A:B Bunch Weights
	No of Bunches	Weight (kg)	No of Bunches	Weight (kg)	
Pre-treatment (March-June 1976)	3.24	28.1	3.06	25.0	1.12:1
A = 100%, B = 50% (July 1976 - June 1977)	13.55	132.1	11.66	109.7	1.20:1
A = 50%, B = 100% (July 1977 - February 1978)	9.30	109.0	8.29	103.0	1.05:1
(March-June 1978)	4.61	61.1	4.71	66.9	0.91:1
No pollination (July - 15th September 1978)	2.90	43.9	2.50	34.9	1.26:1

The above table clearly shows that Plot A is inherently better yielding than Plot B. Yields from Plot A were improved after 100% pollination and the trend was reversed when Plot B received the higher rate of pollination. However, it does appear that reasonable yields can be produced with reduced rates of pollination for mature palms at SOP and it has now been agreed to maintain records in this trial with no pollination and to extend this regime of no pollination into the two fields with tallest palms, A1 (25 ha) and B1 (37 ha), a total of 75 ha. The remainder of the 1969 planting (157 ha) is to be put on a 50% pollination basis, ie alternate rows to be pollinated, the rows being changed every month. The remainder of the estate will remain on 100% pollination as far as labour permits. The existence of bunch rot is least in the 1969 plantings.

(3) Because of the doubts as to the true cause of bunch rot at SOP, there are now (wef 1st April 1978) four observation plots, one each in the 1969 (A3 - 120 palms), 1970 (B9 - 120 palms), 1971 (C5 - 120 palms) and 1972 plantings (D6 - 110 palms). Fortnightly observations are being made with the object of recording over a period of three years frond production, sex and number of inflorescences produced therein, pollination date and performance of developing bunch.

(4) Pollen stocks fell to a low level in July when there were only three days' supply. Stocks have now improved to six days' supply and are expected to improve further when a second deep freezer, which is on order, arrives. No graticule has yet been purchased for the microscope.

7.09 - Pruning

The pruning backlog is bad in the older palm areas. Work has just commenced in the 1969 area Field A1.

B4/B5 have now been completed and B1 completed 2 days ago. B8 was in fact pruned in May 1978 not 1977. With a nucleus pruning gang started in 1969/70 areas, it is hoped pruning backlog can be steadily reduced, but the rate per palm has been increased to 30 cts to make the work attractive.

In 1971 planting one round pruning completed in C11, 12 and parts of C10.

In 1972 planting one pruning round completed in D1, D2, D3, D5 (part) D8, D9, and D12.

In 1973 planting one pruning round completed in all areas, and 2nd round started in E1.

In 1974 planting, one round completed in F1, F14 and part of F16.

8. Production and Collection

8.01 - Crop

1) Agreed that as at present rate the overall crop might be 2,000 tonnes FFB short of the estimate of 51,800 tonnes. Crop estimate was also exceeded in October by some 500 tons.

2) Extraction rate is still slightly below the estimate of 20% but kernel extraction still exceeds the estimate of 3%. FFA is now within reasonable limits.

8.02 - Harvesting & Collection

3) No comments

4) During October, record daily crops were brought in as follows. 325 tonnes on the 13th, 284 tons on the 18th and 274 tons on the 25th.

Agreed that it is good policy for the Estate to maintain its own loading gang, in case of problems with contractors.

(5) For pollination trials at Kebuloh see paragraph 14.

7.09 Pruning

Expenditure - M$26,311 = M$ 8 per mature ha
Estimate - M$93,110 = M$30 per mature ha

(1) Due to the shortage of labour the pruning programme is much behind schedule, many areas not being pruned for more than a year (eg A3 in July 1977 and B8 in May 1977). Because of the backlog, estimates for 1979 will have to be increased. The work is unpopular and the rate (25¢ per palm) will undoubtedly have to be raised until rounds become more regular.

(2) A mechanical pruner has been tried but not found suitable.

8 Production and Collection

8.01 Crop

(1) Production to the end of August was 30,924 tonnes FFB, 8% below the estimate of 33,500 tonnes. August was the only month so far in which the monthly estimate was exceeded. However, a good crop is being harvested in September and with the heavy crop forming in the field, this situation is likely to continue to the end of the year. The overall crop for the estate might be 2,000 tonnes FFB short of estimate of 51,800 tonnes, unless the labour situation improves with a regular intake of, say, 20-25 workers weekly.

(2) Extraction rate averaged 19.74% (estimate 20%) for palm oil and 3.26% for kernels (estimate 3%). Free fatty acid in August was 2.51% and will be higher in September (2.99% to the 12th), which has been a wet month.

8.02 Harvesting and Collection

Expenditure - Harvesting M$351,521 = M$13.4 per tonne FFB
- Collection M$191,793 = M$ 7.3 per tonne FFB

Estimate - Harvesting M$764,050 = M$14.8 per tonne FFB
- Collection M$376,096 = M$ 7.3 per tonne FFB

(1) Costs are well within estimate, harvesting showing a saving.

(2) As noted at the last visit, harvesting rounds are too infrequent and the harvested fruit often sits in the field too long. This time the situation was particularly bad in the 1969/1972 areas (19 to 22 days) because of the Hari Raya holidays. Although a 10-day harvesting round is ideal, under SOP's conditions a 14-day round would generally be acceptable. Although harvesters can earn more in the taller palms, harvesting with sickle is unpopular compared with chisels.

(3) Contractors are operating much as at the last visit, ie in the 1969/70 areas at a rate of M$6.00 per tonne FFB for hand loading and M$5.70 per tonne FFB for net loading, minus 50¢ per tonne for the use of the nets; in the 1973 area the rate is M$5.50 per tonne plus 50¢ for transport of labour. Estate loading and transport of labour is costing about M$7.00-7.50 per tonne FFB.

9 Yields

Comments noted and agreed.

10 Production

Comments noted.

(4) A record crop of 272 tonnes was brought in on 15th September, by contractors and the estate's own transport. The estate will always have to do some of its own loading and it could be in a vulnerable position if all the loading were in the hands of contractors.

9 Yields

9.01 The yield table is at Appendix 4. The yields for the 1969 and 1970 plantings are likely to exceed estimates by comfortable margins and the 1971 yields will probably just achieve estimate. The yields for 1972 and 1973 plantings are disappointing, mainly due to poor upkeep, particularly pollination, and crop will be lost.

9.02 Yields agreed with PM for 1979 estimates are given in paragraph 12.01 below.

10 Production

10.01 The cost of production is summarised at Table 5.

Table 5

Cost of Production
(M$)

	To Date (7 months)	Estimate (12 months)
Crop in Tonnes		
FFB	26,160	51,800
Oil	5,209	10,408
Kernels	857	1,561
Total palm products	6,066	11,969
Palm Products Cost per Tonne		
Revenue		
General charges	320.30*	281.69
FFB purchases	4.92	2.26
Upkeep and cultivation Harvesting and collection	284.37	363.50
Sub-total	609.59	647.45
Manufacture	141.18	127.99
Depreciation	33.03	29.87
Amortisation	72.63	62.40
Total per tonne products	856.43	867.71
Duty	203.17	174.20
Grand Total	1,059.60	1,041.91

* Not up to crop estimate.

11 Immature Areas

11.01 1974 Planting

1) Areas under maintenance and cropping are F1, F2, F3, F14, F16 and F17 and their total hectarage is 318.88 Ha., and not 554 ha.

2) Where areas are being maintained, they are in reasonable condition except for F16, which at the time of V.A.'s visit was over due (last round was in April) Field conditions in the other remaining areas are of course over grown as they have not been maintained for as long as 10 - 12 months, due to the labour shortage.

3) Considering the labour shortage an average of 7 rounds of pollination achieved against the target of 8 rounds per month is not a bad achievement.

4) Agreed to look into this matter.

General charges per tonne palm production are high because of the shortfall in crop, a reflection of the general malaise resulting from the shortage of labour. The significant burden of export duty is also illustrated.

10.02 As to processing, at present levels of throughput there appears to be no problem in operating a one-shift system with overtime as required. On occasions, a full shift is not operated and this has brought the cost of processing to a higher level than estimated. A normal eight-hour shift can cope with about 160 tonnes FFB.

10.03 An effluent pond has been constructed near the muster office and store. The biological oxygen demand level of the stream into which it drains appears to have been reduced but there is the problem of drainage water from the labour compound which dilutes it. Some weirs in the stream require repair.

11 Immature Areas - 1,009.7 ha

11.01 1974 Planting - 898.4 ha

	M$/Ha
Expenditure since planting	2,955
Estimate since planting	5,192
Expenditure 7 months 1978	138
Estimate for year 1978	1,061

(1) This planting should by now be in production but shortage of labour has allowed only fields F1-3 and F14, 16 and 17, totalling 554 ha, to be cropped and maintained as shown in Map 2 at Appendix 1. M$2,103 were spent on constructing 609 harvesters' footbridges. Upkeep of F4 and F12 was started but had to be abandoned due to acute labour shortage. 318.

(2) Field maintenance, particularly weeding, has fallen behind schedule and is now at an unacceptable level. As noted in the last report, some fields are wholly covered with Eupatorium which could present a serious fire hazard during a dry spell; M$30,545 had been provided for two spraying rounds but these could not be done. Because of the backlog in weeding the manurial programme is much behind schedule.

(3) Pollination rounds have been inadequate and the potential crop will not be realised. Only 322 ha were pollinated at an average of seven rounds per month.

(4) In an earlier part of this report (paragraph 7) it was noted that 64 ha of the 1973 planting are being given priority for maintenance operations as recommended at paragraph 12.01 of my last report. Manager Malaysia subsequently suggested that a similar operation be undertaken in a selected area of the 1974 planting. I fully support this and recommend that a similar area be given first class maintenance as I am confident that the return per hectare for a properly maintained field would, in spite of the increased maintenance costs, be considerably greater than at present because of the increased crop that would be borne and that could be harvested without losses in unpruned leaf axils and in weed growth.

5) Nothing more to comment, except that if labour becomes available, it will still be worthwhile to maintain the areas where topography permits.

6) No labour available for undertaking the work.

7) Pest detection team maintained regular survey on all planted areas, monthly in the areas under upkeep and alternately monthly in the other areas.

11.02 1976 Planting - 101.2 ha

1) It is hoped that labour situation will improve to enable proper maintenance of the younger palm areas. Costs have been expensive due to the heavy weed growth.

2) Fertilising of palm only done when circles are clean, thus backlog on manuring is inter-related to the weeding backlog.

4) Flap Gate - to be looked into.

5) Labour not available to undertake the work.

(5) ARAB reported in May 1978 on this planting in their report entitled "Soil Suitability for Oil Palm Cultivation of an Area of 2,916.8 acres of Sarawak Oil Palms SB". The conclusion was that about 26% of the area under survey, ie 771 acres, is not suitable for oil palms on account of topography and soils. The estimated yield was only 3.35 tonnes FFB per acre. This area is demarcated roughly on Map 2 and approximately coincides with the area already not being maintained (see paragraph 7.01(1) of my last report).

(6) No vacancies were supplied in this planting.

(7) Although no pest outbreaks have been reported, this could occur without detection in areas in which maintenance cannot be undertaken. It is important that the pest detection team regularly inspects all planted areas of the estate.

11.02 1976 Planting - 101.2 ha

	M$/Ha
Expenditure to date	= 2,916
Expenditure this year to date	= 160
Estimate to date	= 3,648
Estimate this year to date	= 825

(1) Work on these plantings has not been up to estimate because of the shortage of labour. In G2 (30 ha) where the topography is more broken, two rounds of avenue slashing were completed but upkeep of this block has since been abandoned. Expenditure amounted to 75% of the allocation, while only 48% of the area was covered. As to circle weeding, the estimate provides for nine rounds, but so far only one round has been completed in G1 and G2 and three rounds (one hand and two chemical) in G3. There was very little lalang control. This illustrates the much increased cost in weeding if regular rounds cannot be maintained. In fact one round of weeding after a year of neglect may cost more than the combined cost of four quarterly rounds.

(2) Only 25% of the manuring programme had been completed. The programme for the year is 3 lb CCM66 (March), 1 lb muriate of potash (June), 1½ lb Nitro 26 (July) and 3 lb CCM66 (September). Only the first application of CCM66 had been made by September.

(3) There was no pest outbreak.

(4) Draining has now been completed in G3 (see paragraph 11.02(3) of my last report). The flap gate recommended at S.7(1) of the Summary of the previous report had not been installed; instead the channel in the Luak River had been deepened and straightened in a small part of the stream below the outlet from G3. It was clearly demonstrated during my visit that this did not prevent water, when the river was in spate, from entering G3 and flooding that area. This water could not drain away until the river level had completely fallen, which could be within 24 hours, but it would then take at least another 24 hours to drain G3. There appears to be no alternative to erecting a flap gate, which a carpenter should be able to construct with local materials quite cheaply with the aid of plans already supplied.

(5) No vacancies were supplied.

11.03 1977 Planting - 10.1 ha

The remaining unplanted area has now been planted up.

12 Estimate for 1979

12.01 The long term crop estimate for 1979 was 70,178 tonnes. However it was subsequently agreed that due to our labour problems yields should be discounted by 5%, reducing the tonnage to 66,669 tonnes. Estimated yields for the 1969, 1970, 1971 and 1972 areas reflect this 5% decrease but in view of field conditions, due entirely to shortage of labour, in the 1973 and 1974 areas estimated yields from these areas have had to be drastically reduced. Inadequate pollination rounds will also effect crop in 1979.

12.02 It is difficult to ascertain the general efficiency of Workshops. All our vehicles are now old, and with poor road conditions and a constant turn over in drivers, many of whom are totally unexperienced on joing SOP, breakdowns must be expected. Similar difficulties are experienced in recruiting and retaining good experienced mechanics and so the standard of maintenance is suspect to some degree. We have recently engaged another senior mechanic and hope that standards will now improve.

Estimates for 1979 include two new lorries, two landrovers and a replacement of PM's car.

12.03 The oil evacuation problem, once SLDB move to Bintulu is being looked into and Secretary SOP is currently compiling as much information as possible. However, in order to do a costing exercise we need to know what rates S.L.D.B. will charge for use of their installation and barges at Bintulu. S.L.D.B have been unable to provide this information at time of writing.

.....6/-

Board (mtg 24/11/78) Last part crop down to 54 000 t

Now estimated at 48,500 t

Bd approved staff club furniture $29 000

crane 20,500

forklift truck 100 000

149 500

11.03 1977 Planting - 10.1 ha

	M$/Ha
Expenditure to date	= 971
Expenditure this year to date	= 293
Estimate to date	= 1,340
Estimate this year to date	= 529

This area, H1, comprises the old nursery. It has been well maintained but some items, weeding, roads and bridges, will be overspent by the end of the year. Thinning of the original planting to a stand of 30 ft x 30 ft equilateral has started and should be completed. There is still a small area to plant.

12 Estimates for 1979

12.01 Pollination rounds to the end of 1978 will have been inadequate and this will affect the crop for 1979. If the labour situation does not improve, the crop potential will continue to be depressed to the end of the year. The long-term estimates (LTEs) took account of the effect of the poor maintenance history upon yield and also allowed for the poor topography and soils in the newer plantings. PM has made a further assessment of the yields for 1979 and I have agreed them with him as follows -

	Tonnes FFB/Ha	
Planting	Revised Estimate	LTEs
1969	19.95	21.00
1970	19.95	21.00
1971	19.95	21.00
1972	18.78	19.77
1973 - reasonable land	11.50	15.74
1973 - swamp		13.67
1973 - poor land		12.60
1974 - reasonable land	5.91*	15.29
1974 - poor land		8.80

* Estimated on a harvest area of 319 ha out of 898 ha planted.

The total crop expected in 1979 will be 57,450 tonnes FFB compared with the LTE of 70,178 tonnes.

12.02 As reported last time (paragraph S.8 of the Summary) transport is not being maintained in good condition. Although there is now a Workshop Superintendent, I understand that he is not particularly well qualified. It is intended to put crop collection as far as possible in the hands of contractors. However, it could put the project in a vulnerable position if they had the monopoly of collection and the estate should always be able to maintain a small fleet of transport. It would be advisable to purchase two more lorries with cranes for FFB collection in 1979. Surplus lorries could be sold secondhand to contractors. The estate could

then maintain a fleet of four lorries and five tractors and trailers. PM's car is in a deplorable condition and requires replacing and one more landrover is required for field staff.

12.03 SLDB's decision to evacuate its oil from Bintulu instead of Piasau has forced SOP to examine its own position. There appears to be four alternatives for bulk storage facilities -

(a) to transport palm oil to Bintulu by road for which an estimate would be required for a fleet of about seven tankers and their running costs;

(b) to transport palm oil to Bintulu by barge for which a comparative estimate would be required for two barges and one tug and operating costs;

(c) to acquire existing facilities at Piasau and SOP to operate them; in this case SOP would have to rely upon small 1,000-tonne tankers calling at Miri;

(d) to instal new facilities on the Sibuti River near Bekenu.

Any of these alternatives would involve SOP in considerable additional cost and the merits of each will have to be examined in detail.

13 Climate

Rainfall for the period was as follows -

Month	Six-year Mean (mm)	1978 (mm)
January	293	219
February	165	60
March	128	121
April	110	126
May	206	315
June	226	192
July	149	190
August	199	106
September	201	
October	252	
November	289	
December	329	
Total	2,547	2475

13 Climate

We will attempt to purchase suitable equipment to record sunshine hours and temperature.

14 Kebuloh Experimental Station

Position noted.

J.H.M. WALTON
MANAGER

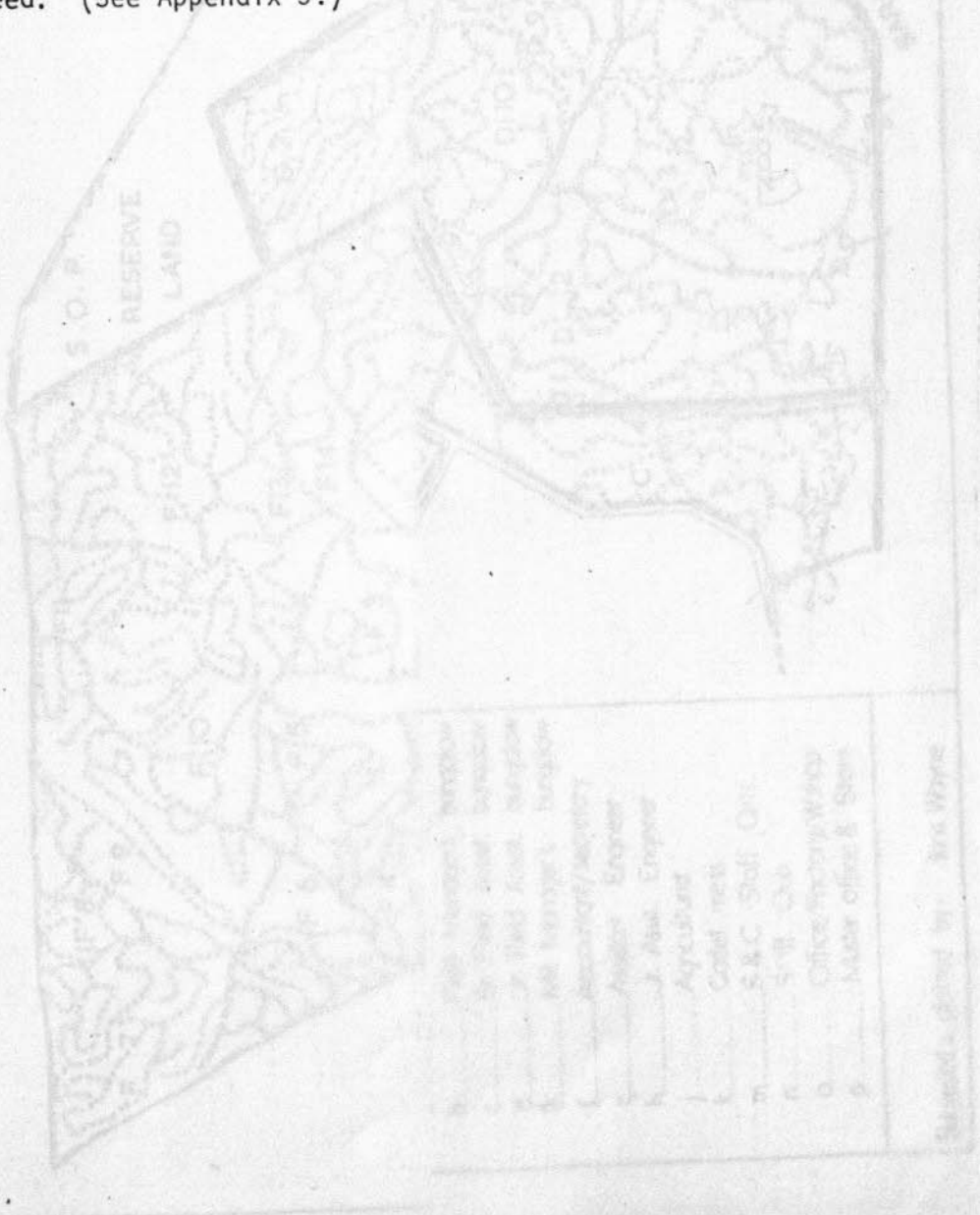
Dated: 17th November, 1978

/cych

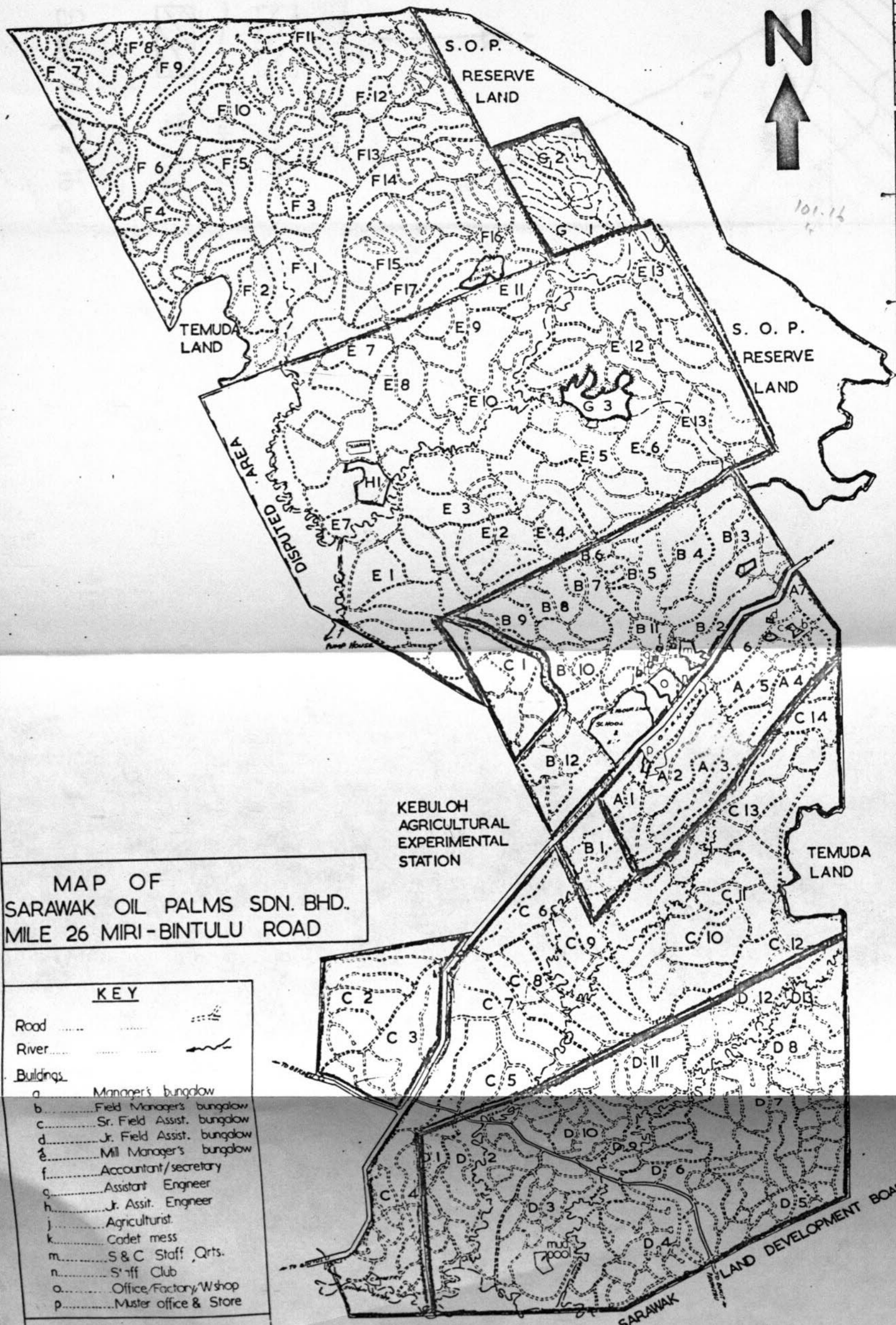
There is much variation between years for rainfall in any one month. For 1978 during the period under review February, May and August were exceptional. September was very wet as in most of south-east Asia and this will have hastened ripening of the crop which has aggravated the labour problems. There are no records of sunshine or temperatures and I recommend that suitable equipment be purchased so that recording can commence in January 1979. One of the problems will be to prevent stealing and vandalism by Ibans.

14 Kebuloh Experimental Station

In response to my approach to the Director of Agriculture, a meeting on research activities on oil palms was held under his chairmanship at the Niah Palm Oil Mill, SLDB, on 17th April 1978. It was agreed that the Department of Agriculture would lay down a trial on assisted pollination. PM and I discussed this with their Agronomist, Mr David Tang Tieng Hua, and it was agreed to make use of their former intercropping experiment planted in 1970. There will be five treatments - no pollination, 50% pollination as at SOP, six, eight and ten rounds pollination per month. Plot size will remain at nine palms plus guard rows and can be doubled by reducing the number of replicates. Manurial rates will be standardised and PM SOP will be consulted. Records to be maintained were discussed and agreed. (See Appendix 5.)



MAP OF SARAWAK OIL PALMS SDN. BHD. MILE 26 MIRI-BINTULU ROAD



KEY

Road .....

River .....

Buildings

a ..... Manager's bungalow
b ..... Field Manager's bungalow
c ..... Sr. Field Assist. bungalow
d ..... Jr. Field Assist. bungalow
e ..... Mill Manager's bungalow
f ..... Accountant/secretary
g ..... Assistant Engineer
h ..... Jr. Assit. Engineer
j ..... Agriculturist
k ..... Cadet mess
m ..... S & C Staff Qrts.
n ..... Staff Club
o ..... Office/Factory/Wshop
p ..... Muster office & Store

Surveyed & plotted by:- Idris Wayne

101.16

1977 DEVELOPMENT

Field	Hect.	UNPLANTED	HA	ACRE
H 31	10·34		10·34	25·55

1976 DEVELOPMENT

FIELD	FIELD HECTARE		TOTAL Hect.	AREA ACRES
G 1	44·52		44·52	110·00
G 2	30·35		30·35	75·00
G 3	26·30		26·30	65·00
TOTAL	101·16		101·16	250·00

1974 DEVELOPMENT

Field	Field Hect.	unplanted Buildings & Rd	Total area Hect.	acres
F 1	61·11		61·11	151.00
F 2	66.77		66.77	165.00
F 3	44.51		44.51	110·00
F 4	55.85		55.85	138.00
F 5	47.35		47.35	117.00
F 6	42.89		42.89	106.00
F 7	42·09		42·09	104.00
F 8	38.85		38.85	96.00
F 9	72.44		72.44	179.00
F 10	77·70	10.93	88.63	192.00
F 11	35·21		35·21	87.00
F 12	62·73		62·73	155.00
F 13	50.99		50.99	126.00
F 14	39·25		39·25	97.00
F 15	53·42		53·42	132.00
F 16	50·99		50·99	126.00
F 17	56·25	6 88	66·13	139·00
Total	898 40	17 81	916 21	2220·00

1973 DEVELOPMENT

Field	Field Hectge	unplanted buildings etc	Total area Hect	Acres
E 1	102.79	0·81	103·60	256·00
E 2	64·75		64·75	160·00
E 3	48·16		48·16	119·00
E 4	54·63		54·63	135·00
E 5	71·22		71·22	176·00
E 6	44·11		44·11	109·00
E 7	125·86	[illegible]	137·60	340·00
E 8	49·78		49·78	123·00
E 9	55·85		55·85	138·00
E 10	58·28		58·28	144·00
E 11	65·15		65·15	161·00
E 12	60·75		60·75	150·00
E 13	112·50		112·50	278·00
1976 G3		26·30	26·30	65·00
Total	913 78	38·85	952·63	2354·00

1972 DEVELOPMENT

Field	Field Hectge	unplanted buildings etc	Total area Hect	acres
D 1	28.43		28·43	70·25
D 2	89·63		89·63	221·49
D 3	111·55		111·55	275·65
D 4	82·45		82·45	203·73
D 5	57·71		57·71	142·60
D 6	56·45		56·45	139·50
D 7	101·33		101·33	250·40
D 8	68·22		68·22	168·57
D 9	30·26		30·26	74·77
D 10	67·92		67·92	167·84
D 11	48·69		48·69	120·31
D 12	35·74		35·74	88·32
D 13	32·33		32·33	79·89
Shlap		18·89	18·89	46·68
Total	810·71	18·89	829·60	2050·00

1971 DEVELOPMENT

Field	Field Hect'ge	unplanted buildings etc	Total Hect	Area Acres
C 1	60·47		60·47	149·43
C 2	63·94		63·94	158·00
C 3	59·08		59·08	146.00
C 4	91·86	12·95	104·81	159·00
C 5	56·66		56·66	140·00
C 6	36·02		36·02	89·00
C 7	55·44		55·44	137·00
C 8	41·68		41·68	103·00
C 9	57·06		57·06	141·00
C 10	92·67		92·67	229·00
C 11	39·66		39·66	98·00
C 12	38·85		38·85	96·00
C 13	71·23		71·23	176·00
C 14	45·73		45·73	113·00
total	810·35	12·95	823·30	2034·43

1970 DEVELOPMENT

Field	Field Hect'ge	unplanted buildings etc	Total Hect	Area Acres
B 1	37·38		37·38	92·38
B 2	48·77	2·85	51·62	127·56
B 3	38·93		38·93	96·21
B 4	34·50		34·50	85·25
B 5	33·44		33·44	82·64
B 6	12·93		12·93	31·89
B 7	19·83		19·83	48·98
B 8	39·59		39·59	97·82
B 9	22·25		22·25	54·97
B 10	22·37		22·37	55·27
B 11	44·86	28·08	72·94	180·23
B 12	48·87		48·87	120·75
total	403·69	30·93	434·62	1073·95

1969 DEVELOPMENT

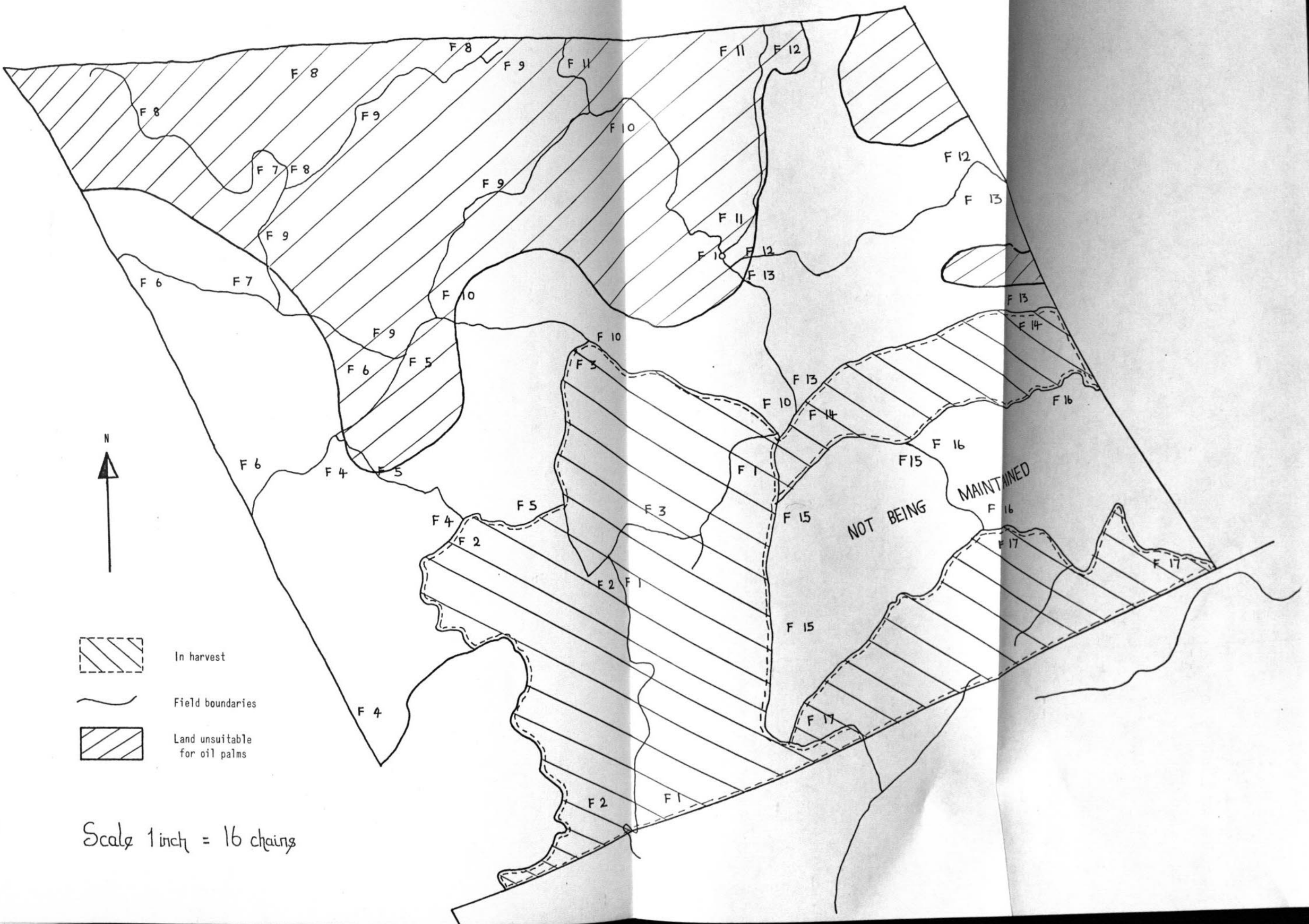
Field	Field Hect'ge	unplanted buildings etc	Total Hect	Area acre
A 1	24·75		24·75	61·61
A 2	33·10	13·34	46·44	114·75
A 3	40·02		40·02	99·90
A 4	29·13		29·13	71·99
A 5	32·45	1·75	34·20	84·50
A 6	22·85	·12	22·97	56·76
A 7	13·18		13·18	32·56
total	195·48	15·21	210·69	520·62

S.O.P. RESERVE LAND - 252.12 HA

APPENDIX 1
MAP 1

APPENDIX 1
MAP 2

SARAWAK OIL PALMS - 1974 DEVELOPMENT AREA



Scale 1 inch = 16 chains

SARAWAK OIL PALMS SDN BHD

BREAK-EVEN ANALYSES - 1974 PLANTINGS

1 Average Yield Break-even Point for 1979 (Assuming 288.4 ha Abandoned)

1.01 Assumptions

(1) The 1974 area to be partially abandoned, ie 610 ha (1,507 acres) will be fully maintained and gradually brought into harvesting and balance totalling 288.4 ha (712.6 acres) will be abandoned.

(2) Cultivation cost remains at the level for 1978 estimate.

(3) Overhead costs as for 1978 estimate plus 3%.

(4) All other costs assumed to remain at 1978 (estimated levels).

(5) Price of kernel and palm oil per advice from Mar O for 1979 estimate as below -

Oil fob M$1,050

Kernel fob M$580

(6) If 288.4 ha are to be abandoned, then the development relating to this will be written off as "sunk cost", ie no amortisation will be charged.

(7) Extraction rates: 3% kernel
20% palm oil.

(8) Manufacturing cost: 60% fixed
40% variable.

1.02 Costs

(1) Fixed Cost

	M$	M$	Per Ha ÷ 3,744
Cultivation (upkeep) -			
1969-1973 areas	2,733,764		
1974 areas (610 ha x M$1,061.43)	647,472	3,381,236	903.11
Amortisation -			
1969-1973 areas	746,866		
610 ha of 1974 area	193,316	940,182	251.12
Depreciation		932,928	249.18
Interest		2,050,000	547.54
	c/f	7,304,346	

	M$	M$	Per Ha ÷ 3,744
b/f		7,304,346	
General administration	1,696,200		
Less M$1.50 per tonne FFB payable to HO London*	77,700		
		1,618,500	445.65
3% for possible increases		50,000	
Direct processing cost (60% fixed)		261,900	69.95
		9,234,746	

* Taken out of "General administration" because this is a variable cost.

(2) Income

Income per hectare assuming yield of (a) 10 tonnes FFB and (b) 20 tonnes FFB per ha -

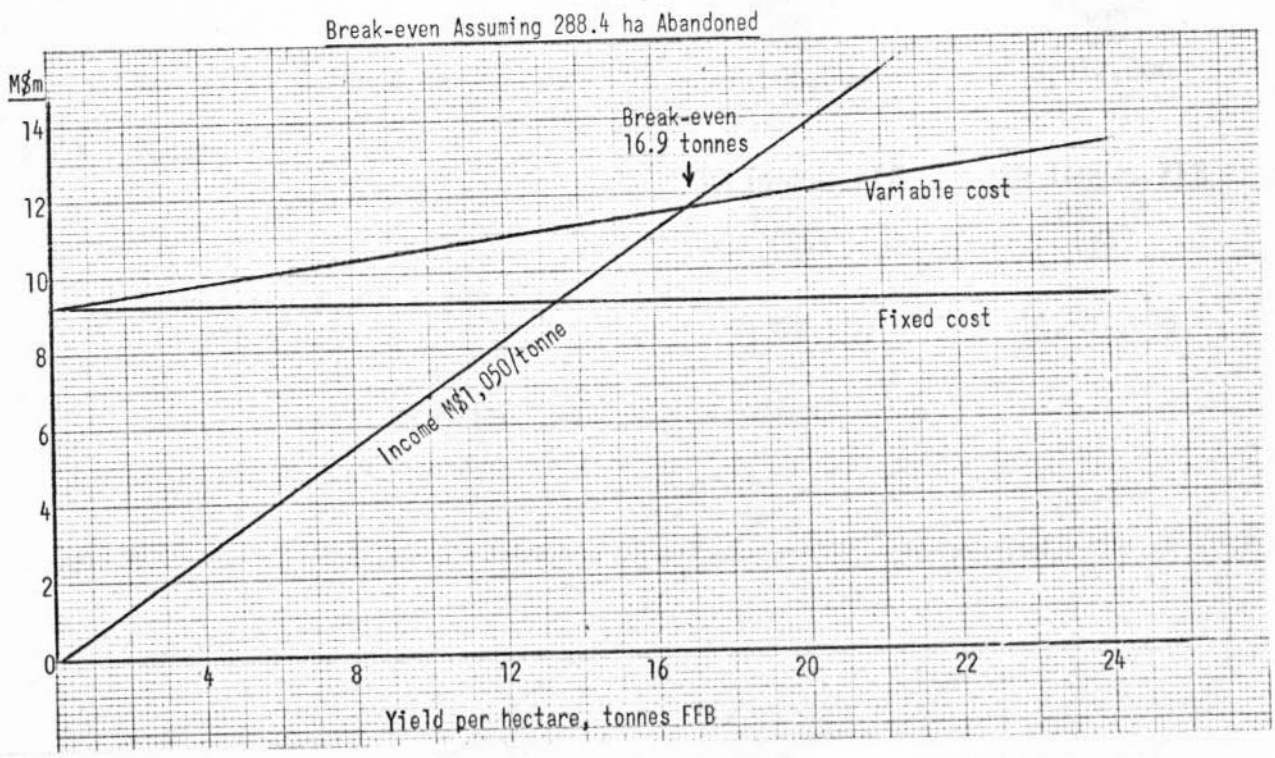
	10 Tonnes FFB per Ha (M$)	20 Tonnes FFB per Ha (M$)
Oil M$1,050 per tonne	2,100.0	4,200.0
Kernel M$580 per tonne fob plus M$56 freight	190.8	381.6
	2,290.8	4,581.6
Less export duty, M$229 per tonne	458.0	916.0
Net income per ha at yields of 10 tonnes and 20 tonnes FFB per ha	1,832.8	3,665.6
Income for 3,744 ha	6,862,000	13,724,000

(3) Variable Cost

Variable cost for 10 tonnes FFB and 20 tonnes FFB -

		10 Tonnes FFB	20 Tonnes FFB
Harvesting and collection (M$21.01 per tonne FFB) (Actual for 1977 to date is lower than estimate)		210.01	420.02
Direct manufacturing cost M$16.91 per tonne oil		33.82	67.64
Export duty (see income)			
	M$		
Transport per tonne oil	6.91		
Storage	15.00		
Lighterage	20.00		
Total	41.91	83.82	167.64
	c/f	327.52	655.30

		10 Tonnes FFB	20 Tonnes FFB
	b/f	327.52	655.30
CDC management fee (M$1.50 per tonne FFB)		15.00	30.00
Kernel per tonne	M$		
Freight	56.00		
Packing	18.81		
Transport	16.50		
Other 20% of cif	11.60		
Total	102.91	30.87	61.74
		(A) 373.52	747.03
Harvesting of 3,744 ha		(37,440 tonnes)	(74,880 tonnes)
Total variable cost (3,744 x (A))		M$1,398,459	M$2,796,917



Break-even point = 16.9 tonnes per ha FFB (6.8 tonnes per acre)

Based on the assumptions stated, SOP would need to produce 16.9 x 3,744 tonnes = 63,300 tonnes FFB in 1979 to break even.

2 Break-even Point, 1979, Assuming No Areas in 1974 Planting Abandoned

2.01 Fixed Cost

	M$
Fixed cost per assumption at paragraph 1.02(1)	9,234,746
Add collection cost for additional 288.4 ha at M$1,061.43 per ha	306,116
Amortisation for 288.4 ha	91,397
Estimate additional general administration 1½% of 1978 estimate	25,000
	9,657,259

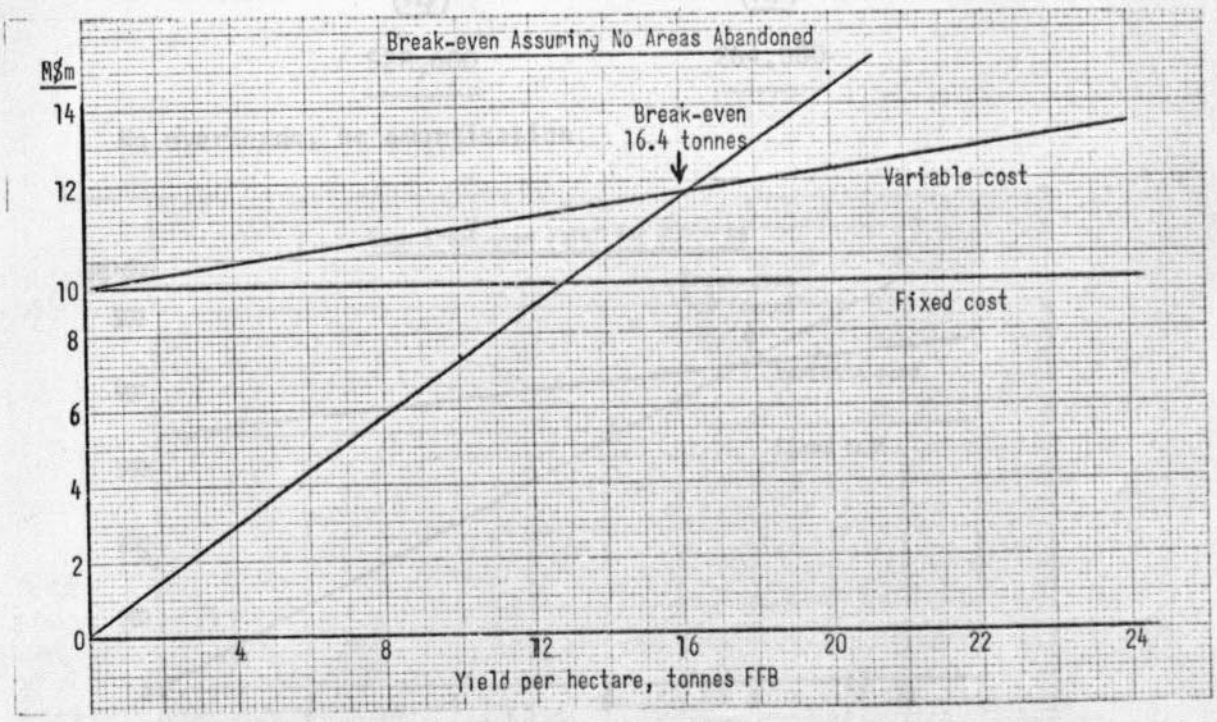
(Overheads would thus have increased by 50,000 + 25,000 = M$75,000 compared with 1978 estimates.)

2.02 Variable Cost

	10 Tonnes FFB per Ha (M$)	20 Tonnes FFB per Ha (M$)
For 3,744 + 288.4 ha	1,506,000	3,012,000

2.03 Income

	10 Tonnes FFB per Ha (M$)	20 Tonnes FFB per Ha (M$)
Income for 3,744 + 288.4 ha (4,032.4 ha)	7,390,580	14,781,000



Break-even point at 16.4 tonnes per ha (or 6.68 tonnes per acre)

Total tonnage required 66,200 FFB.

3 Cash Break-even Point for 288.4 ha

3.01 To determine whether to abandon the 288.4 ha in the 1974 area (assuming that adequate labour is available), the critical question will be - "At what yield per hectare will a net cash return be generated?" For the purpose of the above study, cultivation costs will be the only fixed costs at whatever savings become available with the abandoning of these areas. This is not likely to be material as the area involved is only about 6.95% of the total area. Savings of roughly M$25,000 are estimated for the purpose of this exercise.

3.02 Fixed cost -

	M$
Cultivation cost	306,000
Add estimated savings in overheads if area abandoned	25,000
	331,000

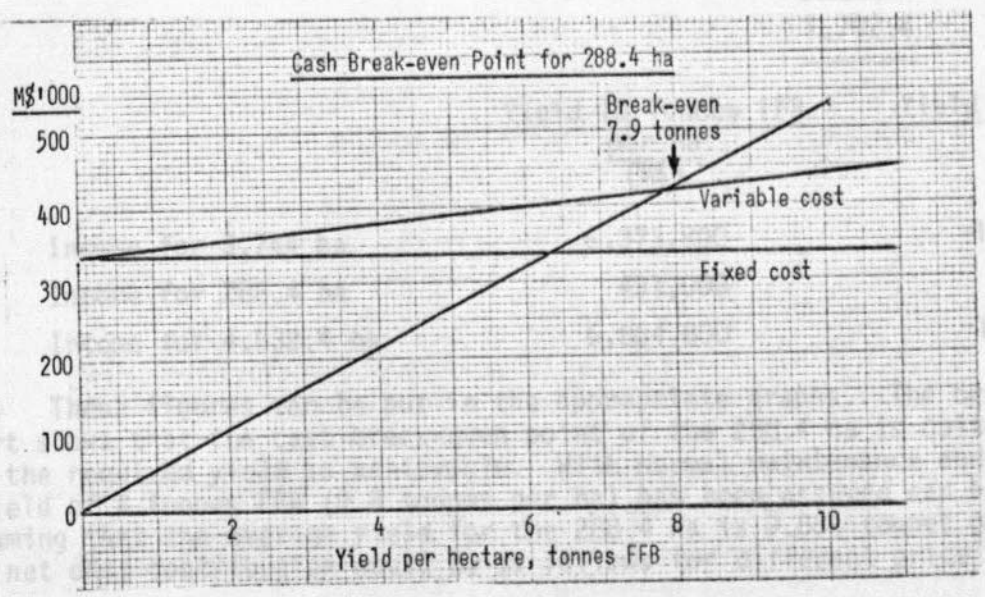
3.03 Variable cost plus M$2.50 for difficult terrain -

10 Tonnes FFB (M$)	20 Tonnes FFB (M$)
108,500	54,250

3.04 Income -

10 Tonnes FFB (M$)	20 Tonnes FFB (M$)
528,600	264,300

No overheads, no amortisation.



Break-even point 7.9 tonnes per ha (or 3.2 tonnes per acre).

4 Variations in Price Assumptions

4.01 Price at paragraph 1.01(5) is as advised by CDC Mar 0.

4.02 Assuming 10% higher price, as at present obtained, the income becomes -

	10 Tonnes FFB (M$)
Oil M$1,050 x 10% x 2 tonnes	2,310.0
Kernels M$580 x 10% + M$56 x 0.3 tonnes	208.2
	2,518.2
Less export duty M$284.65 x 2	569.3
	1,948.9

	Yield 10 Tonnes FFB per Ha (M$)	Yield 20 Tonnes FFB per Ha (M$)
Net income for 3,744 ha	7,296,700	14,593,400
Income for 288.4 ha	562,000	1,124,100
Income for 4,032.4 ha	7,858,700	15,717,500

4.03 Assuming 10% lower price, then income becomes -

	M$
Oil M$1,050 x 90% x 2 tonnes, ie M$895 x 2	1,890.0
Kernels M$580 x 90% + M$56 x 0.3 tonnes	173.4
	2,063.4
Less export duty M$180.5 x 2 tonnes	361.0
	1,702.4

	Yield 10 Tonnes FFB per Ha (M$)	Yield 20 Tonnes FFB per Ha (M$)
Income for 3,744 ha	6,373,800	12,747,600
Income for 288.4 ha	491,000	982,000
Income for 4,032.4 ha	6,864,800	13,729,600

4.04 These figures can be put in the appropriate graphs. The break-even chart shows that the cash break-even point of the 288.4 ha is quite low and the required yield is achievable. With normal maintenance and upkeep, a yield of 4 tonnes FFB (9.8 tonnes per ha) has been assumed can be achieved. Assuming that the average yield for the 288.4 ha is 9.884 tonnes per ha, the net cash contribution would be as follows for different price levels -

Price	A	B	C
Oil fob	1,155	1,050	945
Kernels fob + M$56 freight	694	636	578
Income 2,850.55 tonnes FFB	555,543	552,448	485,277

Cash Outlay	M$
Cultivation cost	306,000
General administration cost, estimated	25,000
	331,000

Variable Cost		A	B	C
37,602 x 2,850.55	107,186	438,186	438,186	438,186
Total	438,186			
Net cash contribution		117,357	84,242	47,091
Net cash contribution per ha		M$406.92	M$292.10	M$163.28

Summary - 1979 Requirements

	Sale Price Oil per Tonne		
	M$1,050	10% Higher	10% Lower
Break-even points, mean yield tonnes FFB per ha -			
(1) 288.4 ha abandoned	16.9	15.7	18.6
(2) 288.4 ha not abandoned	16.4	15.2	18.0
Break-even points, total crop, tonnes FFB per ha -			
(1) 288.4 ha abandoned	63,300	58,600	69,500
(2) 288.4 ha not abandoned	66,200	61,300	72,700
288.4 ha not abandoned and direct costs only charged, break-even points, tonnes FFB per ha	7.9	7.3	8.7
288.4 ha not abandoned and direct costs only charged, break-even points, tonnes FFB per acre	3.2	3.0	3.5

Crop estimate for 1979 : 57,450 tonnes FFB

LTE for 1979 : 70,178 tonnes FFB

SARAWAK OIL PALMS SDN BHD

PROPOSED FERTILISER TRIALS - OP/SOP/79

Treatments

N1 - 1 kg sulphate of ammonia
N2 - 2 kg sulphate of ammonia
N3 - 3 kg sulphate of ammonia

K1 - 1 kg muriate of potash
K2 - 2 kg muriate of potash
K3 - 3 kg muriate of potash

Pr1 - 0.5 kg Christmas Island rock phosphate
Pr2 - 1.0 kg Christmas Island rock phosphate
Pr3 - 2.0 kg Christmas Island rock phosphate

Ps1 - 0.375 triple superphosphate
Ps2 - 0.750 triple superphosphate
Ps3 - 1.50 triple superphosphate

Treatments

Replicate A

N1	K1	Pr1
N1	K2	Pr1
N1	K3	Pr1
N2	K1	Pr1
N2	K2	Pr1
N2	K3	Pr1
N3	K1	Pr1
N3	K2	Pr1
N3	K3	Pr1

Replicate B

N1	K1	Pr2
N1	K2	Pr2
N1	K3	Pr2
N2	K1	Pr2
N2	K2	Pr2
N2	K3	Pr2
N3	K1	Pr2
N3	K2	Pr2
N3	K3	Pr2

Replicate C

N1	K1	Pr3
N1	K2	Pr3
N1	K3	Pr3
N2	K1	Pr3
N2	K2	Pr3
N2	K3	Pr3
N3	K1	Pr3
N3	K2	Pr3
N3	K3	Pr3

Observation Plots

1 - N1 K1 Ps1
2 - N2 K2 Ps2
3 - N3 K3 Ps3
4 - One observation plot with boron
5 - One observation plot with ammonium chloride
6 - One observation with urea
7 - One observation plot with kieserite
8 - Standard recommendation based on soil and leaf sampling. To be done annually and treatment also varying annually

Design - 3^2 x 3 replications (three levels of N, three levels K and three levels of P in the three replicates with eight observation plots)

Total number of plots - 35
Number of observing palms per plot - 16
Number of guard palms per plot - ±18

SARAWAK OIL PALMS SDN BHD

YIELD TABLE

Field	Area	Material	Spacing	Present Stand per Ha 1975	FFB Yield per Ha (tonnes)			
					Year 1976	Year 1977	To Date 1978 (7 months)	Estimate 1978 (12 months)
A1	1969	D x P	8.84	148	17.2	27.9	15.2	
A2	1969	D x P	8.84	148	15.4	18.6	10.1	
A3	1969	D x P	8.84	148	17.3	21.9	14.1	
A4	1969	D x P	8.84	148	21.8	23.1	14.4	
A5	1969	D x P	8.84	148	16.3	17.4	11.9	
A6	1969	D x P	8.84	148	20.6	21.5	13.5	
A7	1969	D x P	8.84	148	19.7	21.0	13.2	
Total/ Average					18.0	21.4	13.1	19.4
B1	1970	D x P	8.84	148	16.5	14.6	10.5	
B2	1970	D x P	8.84	148	18.1	18.1	11.9	
B3	1970	D x P	8.84	148	12.8	18.0	12.3	
B4	1970	D x P	8.84	148	15.9	18.5	12.8	
B5	1970	D x P	8.84	148	13.6	15.4	10.9	
B6	1970	D x P	8.84	148	19.9	23.0	12.1	
B7	1970	D x P	8.84	148	15.8	17.3	10.6	
B8	1970	D x P	8.84	148	12.6	17.8	10.8	
B9	1970	D x P	8.84	148	11.6	15.7	10.7	
B10	1970	D x P	8.84	148	13.3	15.1	10.2	
B11	1970	D x P	8.84	148	12.8	15.5	11.8	
B12	1970	D x P	8.84	148	17.9	20.5	15.2	
Total/ Average					15.0	17.4	11.9	19.4
C1	1971	D x P	8.84	148	14.0	15.2	8.4	
C2	1971	D x P	8.84	148	19.9	20.9	13.4	
C3	1971	D x P	8.84	148	18.7	19.8	12.6	
C4	1971	D x P	8.84	148	14.6	18.3	9.5	
C5	1971	D x P	8.84	148	19.2	18.0	9.7	
C6	1971	D x P	8.84	148	16.8	19.1	11.8	
C8	1971	D x P	8.84	148	15.5	16.9	11.4	
C9	1971	D x P	8.84	148	12.7	15.9	8.9	
C10	1971	D x P	8.84	148	15.6	20.5	10.2	
C11	1971	D x P	8.84	148	17.5	21.0	9.7	
C12	1971	D x P	8.84	148	15.2	19.8	10.2	
C13	1971	D x P	9.14	136	14.3	21.5	11.2	
C14	1971	D x P	9.14	136	15.2	19.0	11.1	
Total/ Average					16.1	18.9	10.7	19.4

YIELD TABLE (contd)

Field	Area	Material	Spacing	Present Stand per Ha 1975	FFB Yield per Ha (tonnes)			
					Year 1976	Year 1977	To Date 1978 (7 months)	Estimate 1978 (12 months)
D1	1972	D x P	9.14	136	16.5	23.8	11.3	
D2	1972	D x P	9.14	136	12.4	16.8	10.2	
D3	1972	D x P	9.14	136	9.3	14.5	6.8	
D4	1972	D x P	9.14	136	8.3	12.8	6.6	
D5	1972	D x P	9.14	136	6.0	16.0	8.2	
D6	1972	D x P	9.14	136	6.5	16.6	9.8	
D7	1972	D x P	9.14	136	4.2	15.4	7.3	
D8	1972	D x P	9.14	136	2.2	9.2	6.7	
D9	1972	D x P	9.14	136	8.8	18.5	11.4	
D10	1972	D x P	9.14	136	10.0	18.5	9.8	
D11	1972	D x P	9.14	136	7.3	21.7	10.5	
D12	1972	D x P	9.14	136	4.8	15.8	8.5	
D13	1972	D x P	9.14	136	3.8	11.7	9.8	
Total/ Average					7.6	15.7	8.5	17.6
E1	1973	D x P	9.14	136		6.5	5.5	
E2	1973	D x P	9.14	136		4.9	5.3	
E3	1973	D x P	9.14	136		-	-	
E4	1973	D x P	9.14	136		1.7	2.0	
E5	1973	D x P	9.14	136		1.7	3.4	
E6	1973	D x P	9.14	136		1.1	3.2	
E7	1973	D x P	9.14	136		2.2	2.2	
E8	1973	D x P	9.14	136		2.9	3.3	
E9	1973	D x P	9.14	136		2.2	3.3	
E10	1973	D x P	9.14	136		1.6	4.3	
E11	1973	D x P	9.14	136		-	0.3	
E12	1973	D x P	9.14	136		-	2.2	
E13	1973	D x P	9.14	136		0.03	2.0	
Total/ Average						2.5	3.0	6.6
F1	1974	D x P	8.84	148			3.1	
F2	1974	D x P	8.84	148			2.8	
F3	1974	D x P	8.84	148			0.5	
F4	1974	D x P	8.84	148			-	
F5	1974	D x P	8.84	148			-	
F6	1974	D x P	8.84	148			-	
F7	1974	D x P	8.84	148			-	
F8	1974	D x P	8.84	148			-	
F9	1974	D x P	8.84	148			-	
F10	1974	D x P	8.84	148			-	
F11	1974	D x P	8.84	148			-	
F12	1974	D x P	8.84	148			-	
F13	1974	D x P	8.84	148			-	
F14	1974	D x P	8.84	148			0.05	
F15	1974	D x P	8.84	148			-	
F16	1974	D x P	8.84	148			0.01	
F17	1974	D x P	8.84	148			2.7	
Total/ Average							1.7	5.3*

* The crop estimate is calculated on the harvested area of 319 ha.

SARAWAK OIL PALMS SDN BHD

COPY OF LETTER TO DIRECTOR OF AGRICULTURE

2048/600

9th October 1978

Mr J.Kong Ted Chong,
Director of Agriculture,
Department of Agriculture,
Kunching,
Sarawak,
Malaysia.

Dear

I am sorry that I was unable to meet you during my visit to Sarawak but hope that your conference was a success. I was very pleased to learn that you held a meeting on agricultural research activities with particular reference to oil palms at Niah on 17th April. I understand that David Tang at Kebuloh has been charged with preparing an experiment on assisted pollination and we discussed the matter during my visit to Kebuloh on 18th September.

Mr Tang suggested that the inter-cropping experiment, which was planted in 1970, should be used for this purpose. There would be four replicates and five treatments, namely -

(1) No pollination

(2) 50% pollination, ie every other row pollinated, eight rounds per month, rows to be pollinated alternated monthly

(3) Six rounds of assisted pollination per month

(4) Eight rounds of assisted pollination

(5) Ten rounds of assisted pollination

Plot size - The present plots contain nine palms plus common guard rows. I understand that it would be possible to double the size of the plots but then there would have to be only two replicates; this lay-out might be preferred. It should be possible to collect pollen within the experiment and Mr Tang was going to discuss the question of pollen collection and its admixture with talc with Mr J.Walton, Project Manager, SOP.

One of the problems will be the mechanical application of the pollen to fairly tall palms and it is suggested that you use the Hatsuta with a lance or the system of bellows as practised by Pamol in Sabah. The experiment should, of course, receive a blower blanket treatment of adequate fertiliser in four split applications per annum. PM, SOP would be able to let Mr Tang have details of rates recommended by Dr Guha for his 1970 planting of palms.

Full records should be maintained of frond production, the sex and number of inflorescences produced therein, pollination date and performance of the developing bunch; the incidence of bunch rot would be recorded. Observations should be made fortnightly and to facilitate the counting of fronds, they should be marked with consecutive numbers monthly.

We also discussed the manurial trial which was planted in 1964 and I hope that it will be possible to continue this experiment with a higher level of maintenance. I noted that pruning rounds have been started and it will be useful to complete them as quickly as possible. Is it possible to provide funds for this operation? Manurial levels should be increased taking into account the age of the palms and records should be maintained of rotten bunches. There is evidence that these palms still require assisted pollination although this could be rather impracticable in view of their height. Pruning and general sanitation in the plantation should help the pollen to move around more easily.

I trust these comments will be of some use.

With kind regards,

Yours sincerely,

L.J.FOSTER
Agricultural Department

LJF/VAT

SOP SOILS DESCRIPTIONS

Great Soil Groups

Red Yellow Podsolic Soils

Parent Material

Red-yellow podsolic soils are predominantly developed over sedimentary rocks, ranging from course grained sandstones to clay shales. Contrasts within the group commonly correlate with differences in parent material. These soils have also developed in old alluvial material and to a lesser eatent in recent alluvial deposits, almost at present floodplain level on some acid igneous and siliceous metomorphic rocks.

Topography

Red-yellow podsolic soils are most extensive on gently rolling to strongly dissected hills, but also occur on river levees and gentle undulations in river floodplains. On slopes of more than 20 - 25" soil depth is commonly limited and at least on slopes greater than 35° these soils, if they occur at all, are found in complex association with skeletial soils.

Vegetation

The primary vegetation is almost entirely mixed Dipterocarp Forest.

Brown Forest Soils

Parent Material

The rocks found beneath Brown Forest soils have a high content of calcuim and range from limestone and marls to calcareous shales and sandstones, intermixed in places with non-calcareous rocks. In places there is an admixture of alluvial material that has acquired a calcuim-rich nature from contact with underlying limestone. The calcareous nature of the parent material is believed to be primarily responsible for the differences between these soils and the associated Red-yellow podsolic soils. Where the soil overlies hard limestone the soil is considered to be colluvial and not residual.

Topography

The landforms found in areas of Brown Forest soils range from rugged karst to gently rolling hills that merge into valley land containing alluvial soils.

Vegetation

The primary vegetation consists of mixed Dipterocarp forest which, on areas of karst in particular, shows specialisation.

Gley Soils

Parent Material

Gley soils are developed largely in marine and riverine clays and to a minor extent in riverine sands.

Topography

These soils are found on flat or gently undulating valley bottoms and old beaches, on low hills and on long gentle dip slopes. Topography is probably the most important environmental factor in the development of these soils. Except where developed in heavy parent material, they are associated entirely with areas of slow external drainage.

Vegetation

The upland residual soils are found under mixed Dipterocarp forest or where recorded at high altitudes under mass forest. The soils derived from recent riverine material bear a cover of freshwater, swamp or riparian forest in the few areas where they have not been cleared for cultivation. Soils from old riverine material are generally found under heath forest and those from marine alluvium under littoral or swamp forest.

SOP SOIL FAMILIES

Nyalau

Parent Material	Predominantly sandstone
Topography	Mainly high ridges and dipslopes of cuestas: some low hills with gentle slopes.
Profile	A moderately thick O and thin A1 horizon overlying a deep yellow sandy loam A2 over a yellowish brown to reddish yellow sandy clay loam B horizon. Generally deep and well drained.
Agricultural Limitations	Susceptable to gully erosion and landslides. Low nutrient levels.

Bekenu

Parent Material	Mixed shale and, predominantly fine, sandstone.
Topography	Mainly low and high ridges with steep and moderately steep slopes.
Profile	A thin O and thin A1 horizon overlying a yellowish fine sandy clay loam A2, over yellowish brown to reddish yellow clay loam to sandy clay B horizon. Moderately deep and moderately well drained.
Agricultural Limitations	Susceptable to gully erosion and landslides. Low nutrient levels.

Merit	
Parent Material	Predominantly shale, in places calcareous.
Topography	Mainly low ridges with gentle to moderately steep slopes.
Profile	A thin or extremely thin O, and thin A, horizon overlying a thin yellowish brown to red clay horizon. Moderately deep and moderately well drained.
Agricultural Limitations	Susceptable to gully erosion and landslides. Nutrient levels are generally low , although moderately high over some geological formations.
Malang	
Parent Material	Young riverine clays.
Topography	Flat to gently sloping low river levees.
Profile	A thin O and thin A1 horizon, overlying a deep yellowish brown dry laom to day A2/B horizon. Imperfectly to well drained.
Agricultural Limitations	Nutrient levels are low to moderate depending on the source of the parent material.

Kabuloh

Parnet Material	Calcareous shale and limestone.
Topography	Karst slopes and gently sloping low hills.
Profile	A thin or extremely thin O, and thin A1 horizon overlying a light yellowish brown clay A/B horizon giving way abruptly to rock. Shallow and moderately well drained.
Agricultural Limitations	Shallow depth in places. Calcium saturated in the sub soil.

Bijat

Parent Material	Young riverine days.
Topography	River basins.
Profile	A thin O, and thin A1 horizon, overlying light grey clay, in places mottled reddish brown, poorly drained.
Agricultural Limitations	Poor drainage, periodic flooding. If drainage improved or controlled fewer limitations.

SOP SERIES SUMMARY

LIKAU SERIES

Profile

Horizon	Depth cm	Description
O	5-10	Impersistent but commonly as thick as 5cm.
A1	0-10	Greyish brown to dark yellowish brown fine sandy loam to fine sandy clay loam (10 YR) Very friable, well rooted.
A2	10-20	Yellow to brownish yellow fine sandy loam to fine sandy clay loam (10 YR) friable moderately well rooted.
B	20-120	Brownish yellow fine sandy clay loam to fine sandy clay (7.5 YR) weakly mottled light grey and reddish brown, firm to very firm, poorly rooted.
C	below 120	Generally within white to brownish yellow parent material.

The soil characteristically has a low base exchange capacity and low base saturation feflecting the dominance of kaolin and quartz and the lack of weatherable minerals in the parent rock. Strong leaching is reflected in the low K and Mg figures.

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PEDON No. 6 NYALAU SERIES INCLUDES LIKAU

Location: 1:50,000 sheet No: 1/109/8 Grid Y887,717.

Parent Material: Fine sandstone of Tertiary Age

Topography: Low hill, approx. 50 feet amplitude

Slope: Mid-slope, 15° aspect east

Vegetation/Land Use: Poor primary log

Drainage: Int. medium,
Ext. well drained

Depth	
0 - 12 cm:	Yellowish brown (10 YR 5/4) sandy loam; weak subangular blocky structure; moist, friable; many roots, few pores; smooth gradual boundary to;
12 - 35 cm:	Yellowish brown (10 YR 5/4) sandy loam; weak subangular blocky structure; moist, friable; many roots, few pores; smooth gradual boundary to;
35 - 60 cm:	Brownish yellow (10 YR 6/6) sandy loam; weak subangular blocky structure; moist, friable; many fine roots, many pores; smooth gradual boundary to;
60 - 90 cm:	Yellow (10 YR 7/8) sandy loam; weak medium subangular blocky structure; moist, friable; few roots and pores smooth gradual boundary to;
90 - 120 cm:	Yellow (10 YR 7/8) sandy loam; weak subangular blocky structure; moist, slightly firm; few pores and roots; merging into;
120- 150 cm:	Yellow (10 YR 7/8) sandy loam; weak subangular blocky structure; moist, slightly firm; few pores and roots; merging into;
150 - 165 cm:	Yellow (10 YR 7/8) sandy loam moist, firm almost massive; few roots.

PEDON 6: NYALAU SERIES
Physico-chemical Data

Lab. No:	MS1354	MS1355	MS1356	MS1357	MS1358	MS1359	MS1360
Depth (cm)	0-12	12-35	35-60	60-90	90-120	120-130	130-165
Sand %	80.8	78.3	77.1	76.5	76.2	75.2	73.9
Silt %	7.8	8.3	7.5	6.8	6.5	7.2	7.1
Clay %	11.4	13.4	15.4	16.7	17.4	17.6	19.0
Texture Class	SL	SL	SL	SL	SL	SL	SL
C %	1.30	0.69	0.33	0.17	0.11	0.09	0.10
N %	0.06	0.03	0.02	<0.01	<0.01	<0.01	<0.01
C/N	22	23	17	17	11	9	10
pH (H_2O)	4.7	4.8	4.8	4.8	4.9	4.9	5.0
pH (KCl)	4.0	4.2	4.2	4.0	4.0	4.0	4.0
Exch. (me/100g) (NH_4OAc, pH 7.0)							
Ca	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mg	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
K	0.09	0.05	0.03	0.03	0.03	0.03	0.03
Na	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CEC	5.89	3.44	2.82	3.02	3.02	2.83	4.03
BS %	2	<	1	1	1	1	1

PEDON 6 NYALAU SERIES

Physico-chemical Data ..... ctd.

Exch. (me/100g) (KCl)							
A1	2.14	1.21	1.18	1.73	1.82	1.96	2.21
H	0.06	0.03	Trace	Trace	0.03	0.06	0.03
CEC	4.58	1.96	1.19	2.89	1.83	2.72	2.83
Ext. Acidity (me/100g)	5.44	8.31	4.83	1.38	0.23	0.81	2.88
Free Fe as Fe_2O_3 (%)	0.59	0.60	0.63	0.60	0.63	0.63	0.60
Clay: Total (%)							
SiO_2	38.0	38.0	37.8	37.8	38.1	39.4	39.9
Fe_2O_3	4.8	4.5	4.5	4.7	4.6	4.6	4.4
Al_2O_3	31.9	33.1	35.9	36.9	34.5	34.7	34.0
Moist ret (%)							
1/10 atm.	18.6	20.4	20.7	22.5	22.2	22.0	25.4
1/3 atm.	13.8	15.9	15.9	16.2	16.1	15.2	16.6
15 atm.	8.5	8.1	8.3	8.2	8.1	7.9	8.4

LABANG SERIES

Profile

Horizon	Depth cm	Description
0	3-10	Impersistent but commonly 1 to 3 cm of humus.
A1	0-12	Dark greyish brown to yellowish brown fine sandy loam to fine sandy clay loam (10 YR) very friable, crumbly, well rooted.
A2	12-60	Yellow to yellowish brown fine sandy clay loam, friable, moderately well rooted.
B2	60-120	Brownish yellow to reddish yellow clay loam to clay (7.5 YR) distinctly mottled light grey to pale yellow and reddish yellow to reddish brown; firm to very firm and dense; moderately well rooted common iron rich and iron coated stones.
C	below 120	Generally beyond auger depth. Light grey to dark grey shale with fine sandstone, above which may be heavily mottled light grey clay.

Chemical characteristics of this soil are similar to Likau series.

PEDON No. 7 BEKENU SERIES
INCLUDES LABANG

Location: Mile 24, Bau-Lundu Road

Parent Material: Fine sandstone of Tertiary Age

Topography: Low hilly, approx. 50 feet amplitude

Slope: Upper slope, 12°

Vegetation/Land Use: Primary forest

Drainage: Int. medium
Ext. well-drained

Horizon	Depth	
A_1-3	0 - 12 cm:	Yellowish brown (10 YR 5/6) sandy loam; weak medium to fine subangular blocky; very friable; many medium to fine roots; few coarse; few fine charcoal fragments; moderate biological activity diffuse boundary to;
B_{11}	12 - 36 cm:	Yellow (10 YR 7/8) sandy loam; weak medium to coarse subangular blocky; very friable; no clayskins; few medium roots; many fine roots; moderate biological activity; diffuse boundary to;
B_{12}	36 - 58 cm:	Yellow (10 YR 7/8) sandy loam; weak coarse subangular blocky; breaking to medium fine subangular blocky; very friable; moderate biological activity; few faint fine mottles; few medium to coarse roots; diffuse boundary to;
B_{21t}	58 - 100 cm:	Yellow (10 YR 7/8) sandy clay loam; very friable; weak medium to coarse subangular blocky; occasional large roots; thin patching cutans; few faint diffuse mottles (red 2.5 YR 4/8) low biological activity; diffuse boundary to;
B_{22t}	100 - 130 cm:	Colour same as above, sandy clay loam; friable; moderate medium subangular blocky; thin patching cutans on ped faces; diffuse boundary to;
B_{23t}	130 - 160 cm:	Colour same as above, fine sandy clay loam; moderate medium subangular blocky; friable; thin patching cutans on roots; no biological activity; diffuse boundary to;
B_{24t}	160 - 180+cm:	Colour same as above, fine sandy clay loam; weak medium to fine subangular blocky; friable; thin patching cutans.

PEDON 7 : BEKUNU SERIES
Physoco-chemical data

Lab. No:	MS1347	MS1348	MS1349	MS1350	MS1351	MS1352	MS1353
Deptn (cm)	0-12	12-36	36-58	58-100	100-130	130-160	160-180
Sand %	75.7	72.1	67.8	66.6	68.4	66.2	64.3
Silt %	8.5	8.9	8.6	8.1	7.6	8.7	8.9
Clay %	15.8	19.0	23.6	25.3	24.0	25.2	26.8
Texture Class	SL	SL	SCL	SCL	SCL	SCL	SCL
C %	2.51	0.57	0.19	0.14	0.10	0.16	0.12
N %	0.17	0.04	0.02	0.01	<0.01	<0.01	<0.01
C/N	15	14	10	14	10	16	12
pH (H_2O)	4.6	4.9	4.8	4.9	5.0	5.1	5.1
pH (KCl)	3.8	4.0	4.0	4.0	3.9	3.9	3.9
Exch. (me/100g) (NH_4OAc, pH 7.0)							
Ca	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Mg	0.21	0.07	<0.01	<0.01	<0.01	<0.01	<0.01
K	0.19	0.05	0.03	0.07	0.08	0.06	0.03
Na	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
CEC	8.46	3.86	4.06	3.65	3.24	3.45	3.65
BS %	5	3	1	2	3	2	1

PEDON 7: BERONG
Physico-chemical Analysis ...ctd.

Exch. (me/100g) (KCl)						2.29	2.34
A1	2.81	1.86	1.89	2.22	2.25	0.06	0.06
H	0.18	0.06	0.06	0.03	0.06	0.52	1.76
CEC	4.66	2.50	1.90	2.16	2.38		
Ext. Acidity (me/100g)	12.58	2.55	2.55	3.12	4.57	4.86	4.82
Free Fe as Fe_2O_3 (%)	0.80	1.18	1.37	1.39	1.38	0.47	0.54
Clay: Total (%)	37.1	38.0	37.9	38.7	39.3	39.2	40.3
SiO_2	6.1	7.0	6.9	7.2	7.2	7.01	6.7
Fe_2O_3	23.6	31.9	32.8	34.5	33.6	32.8	32.8
Al_2O_3							
Moist ret (%)						31.6	30.6
1/10 atm.	27.3	26.4	29.7	29.7	31.0	21.7	22.1
1/3 atm.	19.0	18.7	20.9	21.6	20.1	10.9	11.8
15 atm.	15.6	10.2	11.0	11.1	10.7		

LUAK

Profile

Horizon	Depth cm	Description
0	5-10	Impersistent but up to 5cm thick.
A1	0-10	Brown to dark yellowish brown loam to clay loam (7.5 YR to 10 YR), crumbly, friable, well rooted.
A2/B1	15-30	Yellow to brownish yellow clay loam, firm slightly blocky, moderately well drained (colour as A1).
B2	30-100	Brownish yellow to yellowish brown clay, clearly mottled light grey to pale yellow and reddish yellow to red; very firm to firm; slightly blocky; stoney; moderately well rooted.
C	below 100	Light grey to dark grey shale.

Chemically the soil is similar to Likau and Labang but leaching is less conspicuous.

The Luak series are most common in the B, C and D Planting blocks at SOP.

PINTASAH

Profile

Horizon	Depth cm	Description
O	5-0	Impersistent but commonly as much as 5cm thick.
A1	0-15	Greying brown to dark yellowish brown loam; crumbly; friable; well rooted (10 YR).
A2/B1	15-50	Yellow to yellowish brown clay loam to clay with weak red to strong brown mottles from weathering iron rich shale (10 YR) friable to firm moderately well rooted.
B2 pa	50-120	Reddish yellow to yellowish red clay loam to clay, with red yellow and light grey mottles partly from weathering iron rich shale (7.5 YR to 5 YR) firm to very firm; moderately well rooted; stoney in places.
C	below 120 (generally below auger depth)	Light grey to dark grey shale.

Chemically very similar to the Luak series with high Calcium and Magnesium figures. Leaching is not severe because of the heavy texture.

PEDON No.8 MERIT SERIES INCLUDES LUAK PINTASAN

Location: Mile 26, Bau-Lundu Road

Parent Material: Carbonaceous shale of Tertiary Age

Topography: Low hill, approx. 50 feet amplitude

Slope: Upper slope, 15 degrees

Vegetation/Land Use: Low secondary regrowth

Drainage: Int. medium
Ext. moderately well-drained

Horizon	Depth	
A_{1-3}	0 - 12 cm:	Brown to dark brown (10 YR 4/3) fine sandy clay loam; strong medium to fine subangular blocky; friable; moderate medium to fine roots; moderate charcoal fragments; moderate biological activity; rather sharp boundary to;
B_1	12 - 38 cm:	Brownish yellow (10 YR 6/8) fine sandy clay loam to fine sandy clay; moist, strong coarse to medium subangular blocky; slightly friable; many medium to few fine roots; occasional organic staining on ped faces; diffuse boundary to;
B_{21t}	38 - 60 cm:	Brownish yellow (10 YR 6/8) fine sandy clay loam; moist, moderate medium to coarse subangular blocky; friable; thin patchy clayskins on ped faces and in pores; occasional organic staining along old root channels; few medium roots; no biological activity; diffuse boundary to;
B_{22t}	60 - 90 cm:	Colour same as above; sandy clay; strong coarse angular blocky; firm; discontinuous clayskins on ped faces; very few faint red mottles; very few fine roots; diffuse boundary to;
B_{23t}	90 - 120 cm:	Colour same as above; clay; strong coarse angular blocky; firm; faint reddish mottles increasing with depth; no root; discontinuous thin clayskins; diffuse boundary to;
B_{24t}	120 - 155+cm:	Colour same as above; clay; strong coarse angular blocky; firm; common faint mottles (red 2.5 YR 4/8) thin patchy argillans; no root; no biological activity; occasional fine pieces of completely weathered rocks.

Taxonomic Classification: TYPIC (OXIC) PALEUDULT.

Remarks: Top 60 cm of material is probably colluvial

PEBON 8: MERIT SERIES
Physico-chemical Data

Lab. No:	MS1341	MS1342	MS1343	MS1344	MS1345	MS1346
Depth (cm)	0-12	12-38	38-60	60-90	90-120	120-150
Sand %	62.1	59.4	56.1	51.6	44.0	44.0
Silt %	16.5	15.5	14.7	13.8	13.8	15.0
Clay %	21.4	25.1	29.2	34.6	42.2	41.0
Texture Class	SCL	SCL	SCL	SCL	C	C
C %	2.45	0.69	0.31	0.21	0.16	0.21
N %	0.16	0.05	0.02	0.02	0.01	0.02
C/N	15	14	16	11	16	11
pH (H_2O)	4.5	4.6	4.8	5.0	5.1	5.1
pH (KCl)	3.7	3.8	3.8	3.8	3.8	3.8
Exch. (me/100g) (NH_4OAc, pH 7.0)						
Ca	0.26	0.05	0.20	0.05	<0.01	0.15
Mg	0.29	<0.01	<0.01	<0.01	<0.01	<0.01
K	0.08	0.07	0.12	0.05	0.06	0.06
Na	<0.01	<0.01	0.02	<0.01	<0.01	<0.01
CEC	13.17	7.57	6.78	8.69	9.62	9.32
BS %	5	2	5	1	1	2
Exch. (me/100g) (KCl)						6.56
Al	5.66	4.78	5.17	6.07	6.57	0.03
H	0.11	0.06	0.06	0.03	0.05	6.94
CEC	4.79	5.87	6.38	7.86	9.55	10.03
Ext. Acidity (me/100g)	17.81	10.37	9.01	7.07	7.98	2.75
Free Fe as Fe_2O_3 (%)	1.38	1.73	1.85	2.47	2.95	
Clay: Total (%)	37.3	39.6	40.3	38.9	40.6	41.1
SiO_2	7.9	8.4	8.8	8.8	9.6	9.2
Fe_2O_3	26.0	28.4	28.8	27.4	29.3	29.5
Al_2O_3						
Moist ret (%)						
1/10 atm.	39.6	34.0	36.7	38.5	42.2	41.5
1/3 atm.	26.2	24.3	25.8	28.5	32.7	31.3
15 atm.	15.3	12.6	13.2	15.9	19.8	19.4

MALANG

Profile

Horizon	Depth cm	Description
O	5-0	Imperisitent but may be as much as 5 cm of litter and leaves.
A1	0-15	Dark yellowish brown loam to clay loam, crumbly, well rooted.
A2	15-30	Yellow to yellowish brown clay loam to clay (10 YR); well rooted; merges to B horizon.
B	30-120	Yellow to yellowish brown clay, lightly mottled with light grey, to dark reddish brown (10 YR); slightly blocky; moderately well rooted.
Cg	below 120 (in places beyond auger depth)	Grey clay to silty clay, mottled reddish brown to olive brown (5Y-5GY). The water table usually occurs within this zone.

The soil is characteristically uniform above the water table.

Morphologically this soil is very similar to the Kabuloh series although the Kubuloh is derived from calcareous shale.

KABULOH

Profile

Horizon	Depth cm	Description
0	5-0	Impersistent, where present less than 5 cm thick.
A1	0-8	Dark greyish brown loam to clay loam (10 YR) friable but slightly plastic when moulded; crumbly; well rooted.
A2	7-10	Light yellowish brown clay loam to clay; (2.5 YR); firm slightly blocky well rooted.
B	10-100	Light yellowish brown clay; very firm dense (2.5 YR) slightly blocky moderately well rooted; distinctly mottled dark brown by ferromaganese concretions.
C	below 100	Light grey to dark grey shale above which may be a light grey clay mottled brownish yellow and dark brown.

This series has a high CEC pH maganese and calcium and magnesium attributed to the parent material.

Weathering mark or even chalk may occur in the series.

Malang and Kabuloh often occur together.

SAMARAHAN

Profile

Horizon	Depth cm	Description
0-A1	15-0	Dark greyish brown peaty loam.
Bg	0-10	Greyish to brown clay loam to clay mottled reddish brown and light grey
Cy	10-100+	Light grey to greenish grey clay, in places dark grey. Reddish brown to olive mottles in top part of horizon. The water table lies within this horizon.

Lower horizons sometimes contain silty clay.

CLASSIFICATION CHART OF SOP SOILS

Great Soil Group	Origin of Parent Material	Other Features	Soil Family	Soil Series
Red-Yellow Podsolic Soils	Residual	Light texture	Nyalau *	Likau
		Medium texture	Bekenu *	Labang
		Heavy texture	Merit *	Luak Pintasah
	Alluvial	Heavy texture	Malang	Malang
Brown Forest Soils		Heavy texture	Kabuloh	Kabuloh
Gley		Heavy texture	Bijat	Samarahan

* DETAILED PROFILE DESCRIPTIONS 1977 MALAYSIAN SOCIETY OF SOIL SCIENCE.