

Report on a Detailed Soil Survey
of
OYA ROAD
AGRICULTURAL STATION
3 rd Division

by
I. M. Scott
Soil Surveyor

REPORT ON A DETAILED SOIL SURVEY

OF

OYA ROAD

AGRICULTURAL STATION

3RD DIVISION

by

I.M. SCOTT
Soil Surveyor.

Summary

Part II General

Introduction

Location

Climate

Geology

Vegetation

SUMMARY

A soil survey of 33.3 acres near 22nd mile, Sibul-Ulu Oya Road was undertaken at a detailed level during April 1964. The area is the nucleus of a proposed agricultural station. Upland soils are derived largely from shales and sandstones and are typical of soils in this general area. The soil series encountered are defined and sample profiles are described in detail. Analytical data at present available for these profiles are included.

Other Alluvial and Spodosol Soils

Part III Detailed Profile Descriptions

Soil Series

Soil Series

Soil Series

Soil Series

Soil Series

Soil Series

References

PLATES

1. Location and Geology

2. Map of rainfall at Sibul

3. Vegetation and Soil Use

4. Soil Series and Profile

CONTENTS.

			Page
Summary	.....	.....	ii
<u>Part I: General</u>			
Introduction	.....	.....	3
Location	.....	.....	3
Climate	.....	.....	5
Geology	.....	.....	5
Topography	.....	.....	7
Vegetation and Land Use	.....	.....	
<u>Part II : Soils</u>			
Method of survey	.....	.....	9
General statement on the soils of the area	.....	.....	12
Soil Classification	.....	.....	13
Description of the soil series	.....	.....	13
Pasai Series	.....	.....	16
Lutong Series	.....	.....	18
Likau Series	.....	.....	20
Siong Series	.....	.....	23
Malang Series	.....	.....	25
Semilajau Series	.....	.....	27
Anderson Series	.....	.....	27
Other Alluvial and Hydromorphic Soils	.....	.....	
<u>Part III: Formal Profile Descriptions</u>			
Pasai Series	.....	.....	29
Lutong Series	.....	.....	38
Likau Series	.....	.....	42
Siong Series	.....	.....	50
Malang Series	.....	.....	54
Semilajau Series	.....	.....	58
References	.....	.....	60

FIGURES

1.	Location and Geology	.....	2
2.	Monthly rainfall at Sibul	.....	4
3.	Vegetation and Land-Use	.....	6
4.	Rentises and profile pits	.....	10

TABLES

	Page
1. Analytical data, Pasai Series (Profile 1) ...	30
2. Analytical data, Pasai Series (Profile 2) ...	32
3. Analytical data, Pasai Series (Profile 3) ...	34
4. Analytical data, Pasai Series (Profile 4) ...	37
5. Analytical data, Lutong Series (Profile 5) ...	39
6. Analytical data, Lutong Series (Profile 6) ...	41
7. Analytical data, Likau Series (Profile 7) ...	43
8. Analytical data, Likau Series (Profile 8) ...	45
9. Analytical data, Likau Variant (Profile 9) ...	47
10. Analytical data, Siong Series (Profile 10) ...	51
11. Analytical data, Siong Series (Profile 11) ...	53
12. Analytical data, Malang Series (Profile 12)...	55
13. Analytical data, Malang Series (Profile 13)...	57
14. Analytical data, Semilajau Series (Profile 14)	59

PLATES.

1. Pasai Series	.....	.....	.....	14
2. Sikau Series	.....	.....	.....	19
3. Siong Series	.....	.....	.....	21
4. Malang Series	.....	.....	.....	24

MAPS.

Soils Map				in end pocket
-----------	-------	-------	-------	---------------

NOTE ON THE SOILS MAP

As stated on page 7, Lands and Surveys Department Miscellaneous Plan No. F3/5-204 was used during the survey as a base map. Following the survey additional form line data were supplied on Miscellaneous Plan No. F3/5-257(B). The latter was on a scale of 1 chain to 1 inch and this scale was used for the final field map. Form line and boundary data in the east of the area have been photographically reduced from a direct tracing of the plan and can be taken as correct. These data in the west of the area are based on the earlier plan which was on a scale of 2 chain to 1 inch. The adjustment was made by pantograph and there may be some slight distortion. The original Lands and Surveys Dept. plans should be taken as the authority for the boundary, not the map attached to this report.

- 1 -

PART I

G E N E R A L

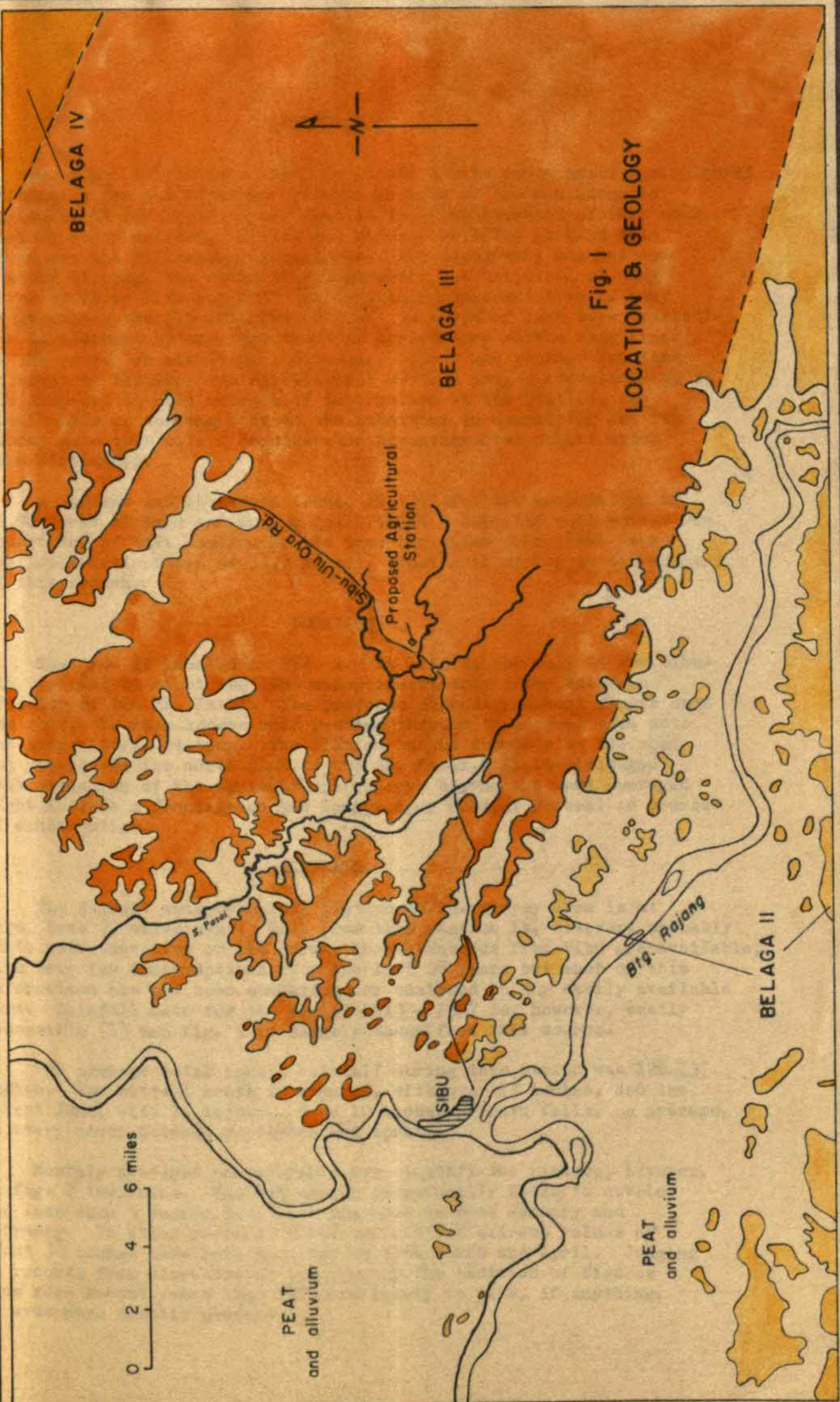


Fig. 1
LOCATION & GEOLOGY

INTRODUCTION

Work was initiated in 1957 to locate a site for a small Agricultural Station on the new Sibul-Ulu Oya road in view of the considerable agricultural development envisaged in the neighbourhood of this road when it was completed. A site was finally selected at 22nd mile which met the following requirements: the topography was not too steeply sloping, the soils were apparently not untypical of many parts of Third Division and were certainly representative of many tracts along the Sibul-Ulu Oya road and 50 acres of land were available for development by the Department of Agriculture within easy reach of the road. In addition, a Secondary School was planned for land adjacent to the proposed Agricultural Station and, particularly as it was proposed to hold courses of instruction at the Station, the possibility of sharing many of the amenities in developing the two blocks gave this site a considerable advantage over others which were considered.

A warrant was therefore issued in 1963 for the acquisition of 81.96 acres of land and during April, 1964 a detailed soil survey was undertaken of that portion of the area for which form lines were available (calculated as 33.3 acres). That soil survey is the subject of this report.

LOCATION

The area is located on Fig. 1. It lies to the east of the Sibul-Ulu Oya road at about the 22nd mile, immediately after the main crossing of the Sg. Pasai. The proposed Secondary school fronts onto the road, the main access road passing through the school area into the Agricultural Station. The station has no frontage on the road but extends to the north bank of the Sg. Pasai. It is envisaged that extension of the agricultural reserve beyond the area surveyed might include a frontage on the Tanggi Spur road, at present in course of construction.

CLIMATE.

The nearest meteorological station to the survey area is at Sibul, some 22 miles away. Data from this station is, however, probably quite representative of the survey area. Records from Sibul are available, with very few interruptions, for the last 28 years but much of this information has not been summarised or analysed in any easily available form. Rainfall data for the period 1915 - 1957 is, however, easily accessible (1) and fig. 2 is largely taken from that source.

The average total annual rainfall during this period was 126.13 inches. The wettest month is January, with over 13 inches, and the driest June, with $7\frac{1}{2}$ inches. Over 10 inches of rain falls, on average, in every month between September and April.

Monthly averages considerably oversimplify the picture, however, as fig. 2 indicates. The wet season occasionally fails to develop and less than 5 inches have been recorded in both January and February. In other years it develops late and extreme values of about 30 inches have been recorded in both March and April. Judging by records from elsewhere in the country the addition of figures from more recent years than 1957 are likely to give, if anything, an even more erratic picture.

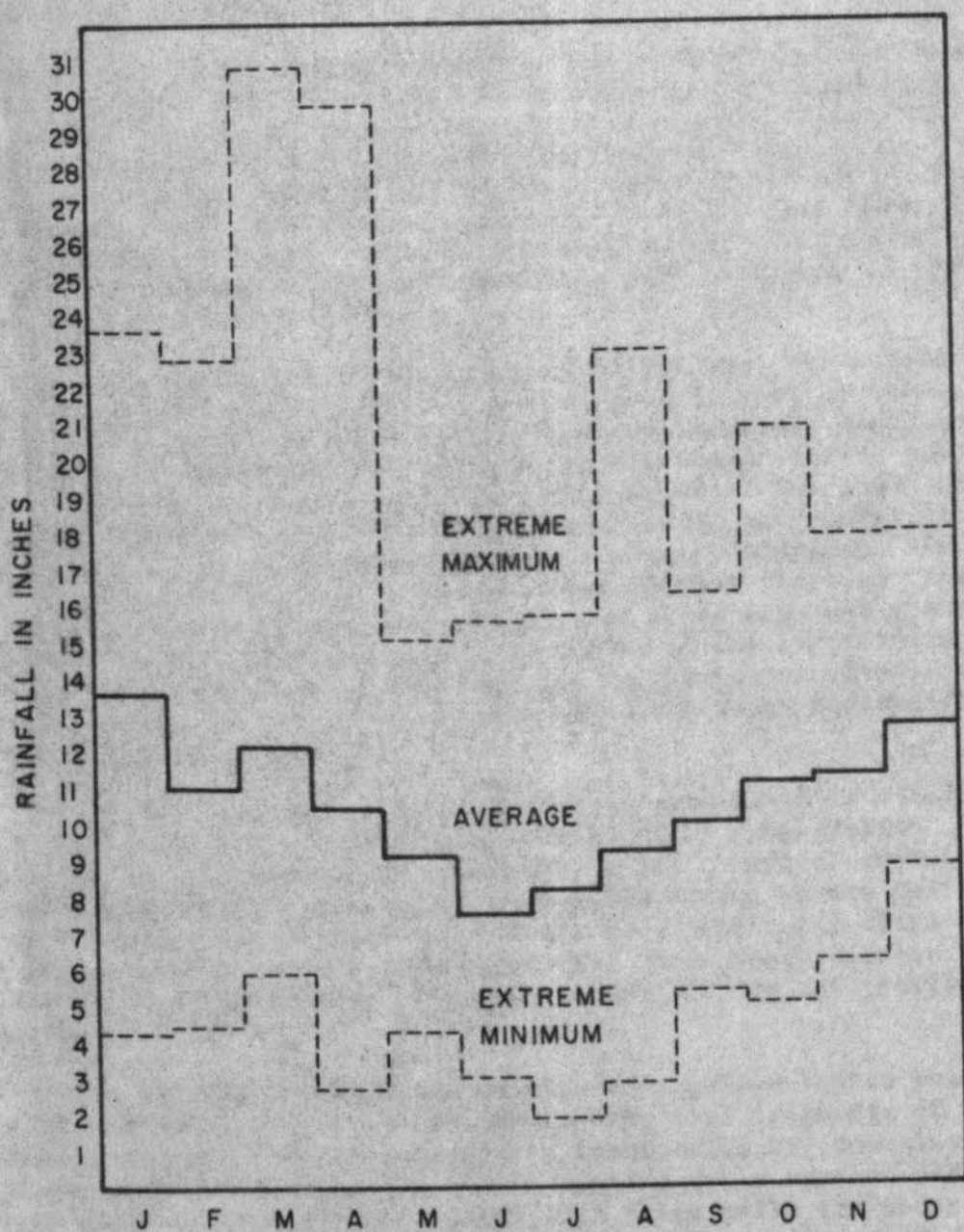


Fig. 2: Average and extreme monthly Rainfall (1915 - 1957) at Sibu

While it is thus impossible to easily characterise the distribution of rainfall through the year, it can be said that by Mohr's classification (2) the survey area is within a "continuously wet" belt, as is much of the country. Bottomlands are flooded intermittently during the year and upland soils are thoroughly leached.

GEOLOGY

The area lies fairly centrally within Stage III of the Belaga Formation. This state is considered to be Middle to Upper Eocene in age, the rocks within it outcropping over some 1,200 square miles of country in a broad East-West belt. The lithology has been described by Wolfenden (3).

Arenaceous rocks are more important in this part of the Formation than in any other part but argillaceous rocks are still dominant. They consist largely of "argillite, slate, occasional phyllite, graywacke and rare beds of greywacke conglomerate. The rocks are steeply dipping and commonly cut by thin quartz veins" (3) - Beds of sandstone, where present, are commonly up to 300 feet thick and are well-bedded, hard and medium-to coarse-grained. "Exposures of thin beds of fine-grained sandstone alternating with thin beds of argillite and slate are widespread" (3).

The last-quoted description appears to fit best the conditions within the survey area. Weathered rock exposed by work on the access road consists almost entirely of argillaceous material, described as shale in the soils section of this report, and in nearby cuttings on the main road sandstone bands were only noted at one point about $\frac{1}{4}$ mile from the station. The upland soils within the survey area, however, appear to be of mixed origin, fine sandy clays and fine sandy clay loams being more extensive than heavier clays and weathered fragments of iron-enriched arenaceous rocks being frequently seen in stonelines in the lower subsoil. While some of the light-textured profiles investigated were very deep and weathered parent material was not located, the majority overlies non-sandy clays derived from weathered argillaceous rocks.

It appears, therefore, that the survey area is underlain largely by shales in which are interbedded thin bands of fine-grained sandstone. As has been found elsewhere, a small band of sandstone in the underlying rock usually has a noticeable effect on the texture of the soil mantle over a wide area. Where deep fine-sandy clays and clay loams occur on summit lines, however, it is more probable that thicker bands of arenaceous rock are responsible for the profile character.

In the extreme south of the station very pale-coloured soils with very coarse textures are present. Iron-rich fragments of weathered rock are largely replaced in these soils by accumulations of quartz gravel. By comparison with similar soils exposed elsewhere in deep road-cuttings it is believed that these soils are underlain by grey carbonaceous shales cut by numerous thin quartz veins.

TOPOGRAPHY

The area consists of moderately to steeply rolling country with a limited development of bottomland flats. The hills rise to over 150 feet above sea level and are mainly rounded in profile. Upper slopes generally have a slope of 5 - 15° while lower slopes are chiefly 20 - 25°. In the east the topography is more dissected than in the west and many of the hills are broken by deep gullies.

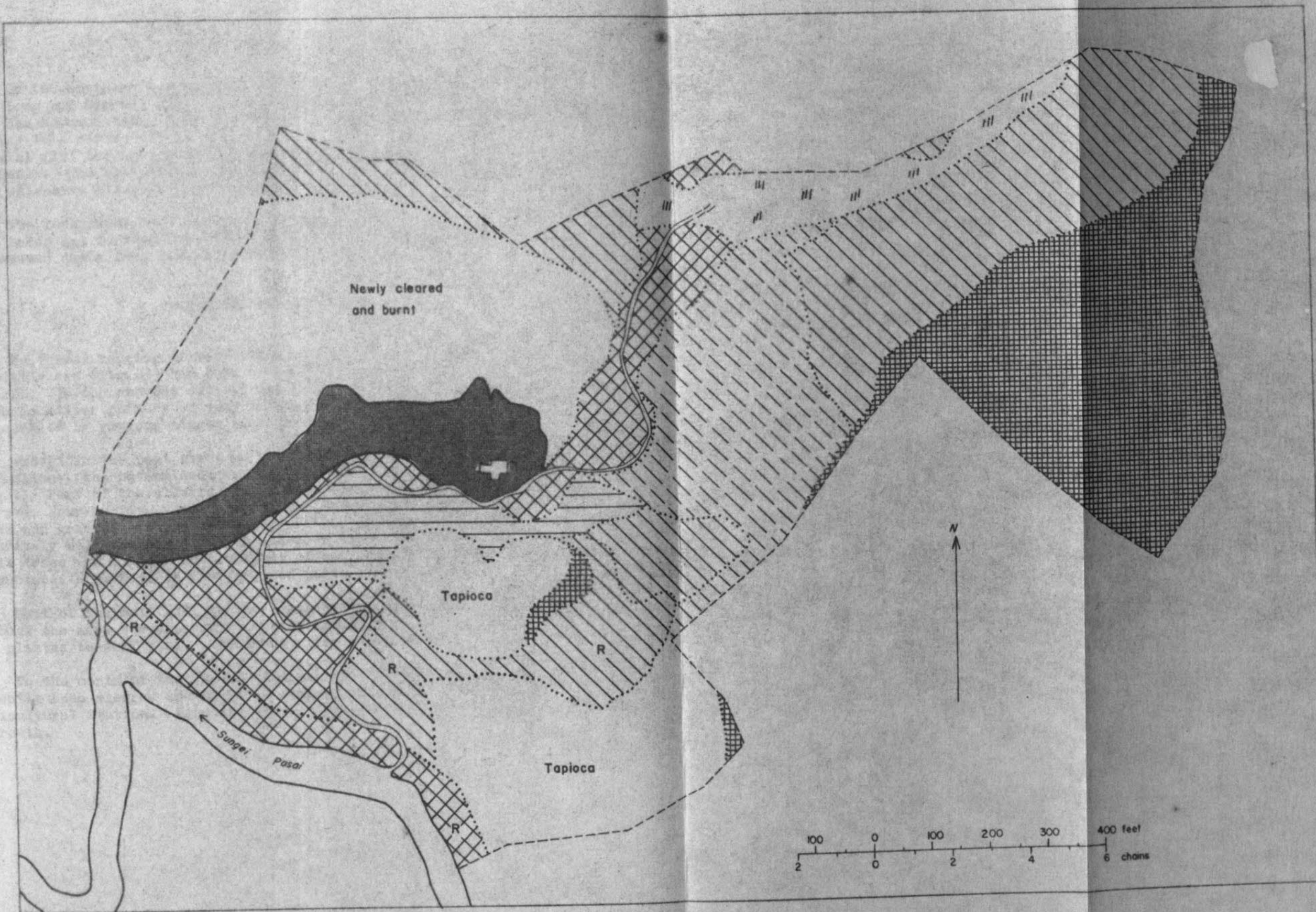
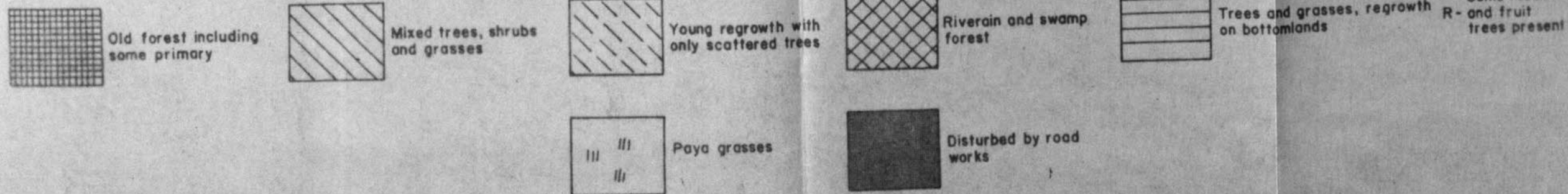


Fig. 3: SCHEMATIC VEGETATION and LAND USE MAP



On the northern boundary of the area the hill land drops sharply to a long but narrow 'paya' in which a variable depth of peat and muck has accumulated. From this 'paya' a small stream issues, running in a rather narrow valley. This widens into a quite extensive alluvial flat through which the stream meanders before entering the Sg. Pasai. The bottomlands associated with this stream are the only extensive alluvial tracts in the surveyed area.

The topography is illustrated in Map 1. The form lines are taken from Lands and Surveys Department Miscellaneous Plan No. F3/5 - 204. An assumed datum from B.M. 111 (of 56.46 feet) was taken.

VEGETATION AND LAND USE

No formal mapping of vegetation and land use was attempted but a schematic map (fig. 3) has been drawn up on the basis of rentis records. In the extreme east of the area some high forest is found which is either primary or very old secondary. Elsewhere the uplands are mantled by various stages of regrowth vegetation.

Except in the peat swamp on the northern boundary, where grassland is dominant, the bottomlands are largely under various stages of forest. Part of the alluvial tract near the access road was used for wet padi four or five years ago and now bears a cover of scattered trees and grasses. Close to the Sg. Pasai, and particularly on relatively well-drained sites on and near the levee, many rubber and fruit trees are found. Rubber trees of various ages are sporadically encountered elsewhere in the forested parts of the area.

Most of the main hill to the south of the stream which runs through the area was cleared two years ago from secondary forest and planted to hill padi. It is now under tapioca (about 7 months old).

To the north of the access road the main hill flanks have recently been cleared and burnt in connection with the proposed Agricultural Station. Here the land is bare or under very young regrowth.

PART II

SOILS

METHOD OF SURVEY.

The Soil Surveyor was assisted by five junior staff plus local labourers. Such a large party was employed as the project was used as a training course for new assistants in addition to being part of the field programme.

Rentises were cut across the area on a rough grid pattern (fig.4) using land chains and a 2-inch compass. Auger samples were taken along each rentis at 100 feet intervals and at a variable distance along the entire boundary. Check points were then sampled between the rentises.

On completion of the routine survey fourteen profile pits were dug at representative sites. Descriptions of these profiles are given in Part III.

GENERAL STATEMENT ON THE SOILS OF THE AREA.

The rocks underlying the area are a complex of shale, sandstone and quartz veins. Shale in this context is used in a rather general sense: the argillaceous rocks probably vary considerably in texture and composition. All are deeply weathered, to the extent that only in one profile was recognisable rock seen below the solum, (Profile 2). The exposures in nearby road cuttings suggest that weathering rock sufficiently fresh for the original structure to be apparent rarely approaches within less than 10 feet of the surface except on very steep slopes. The upland soils of the area are therefore generally moderately deep to deep and there is little barrier to root penetration.

A feature of the weathering process in this area is that iron tends to be leached out of the soil and the well-weathered rock and to be deposited lower down in the weathering zone. Deposition takes place generally along structural lines in the original rock, presumably due to the ease of water movement along such zones in comparison to that in the rather dense weathering product of the shales themselves. Deposition also appears to take place, however, in the relatively porous material present in the weathering zone where a thin band of sandstone was initially interbedded with the shales.

Above the zone of recognisable weathered rock, therefore, there is commonly a zone of pale-coloured dense, sticky, easily eroded clay cut by bands of ironpan or iron-enriched weathered rock, the disposition of these banks reflecting old structure lines or, more rarely, fossil root channels.

As the soil mantle develops the hard iron-rich bands disintegrate to gravel-size fragments and are redistributed at the base of the B horizon as a 'stoneline.' This gravel is black, purple or red in colour and generally breaks easily. It usually shows either the laminar structure of shale or the coarse texture of sandstone. Within the 'stoneline' both types are encountered with equal frequency but, as iron-enrichment by the means described is more likely to take place in a sandstone band than in shale and therefore to make the former more resistant, this does not imply that sandstone and shale are present in equal proportions in the underlying rock. Normally, argillaceous rocks are dominant, sandstone being present only in thin or isolated bands.

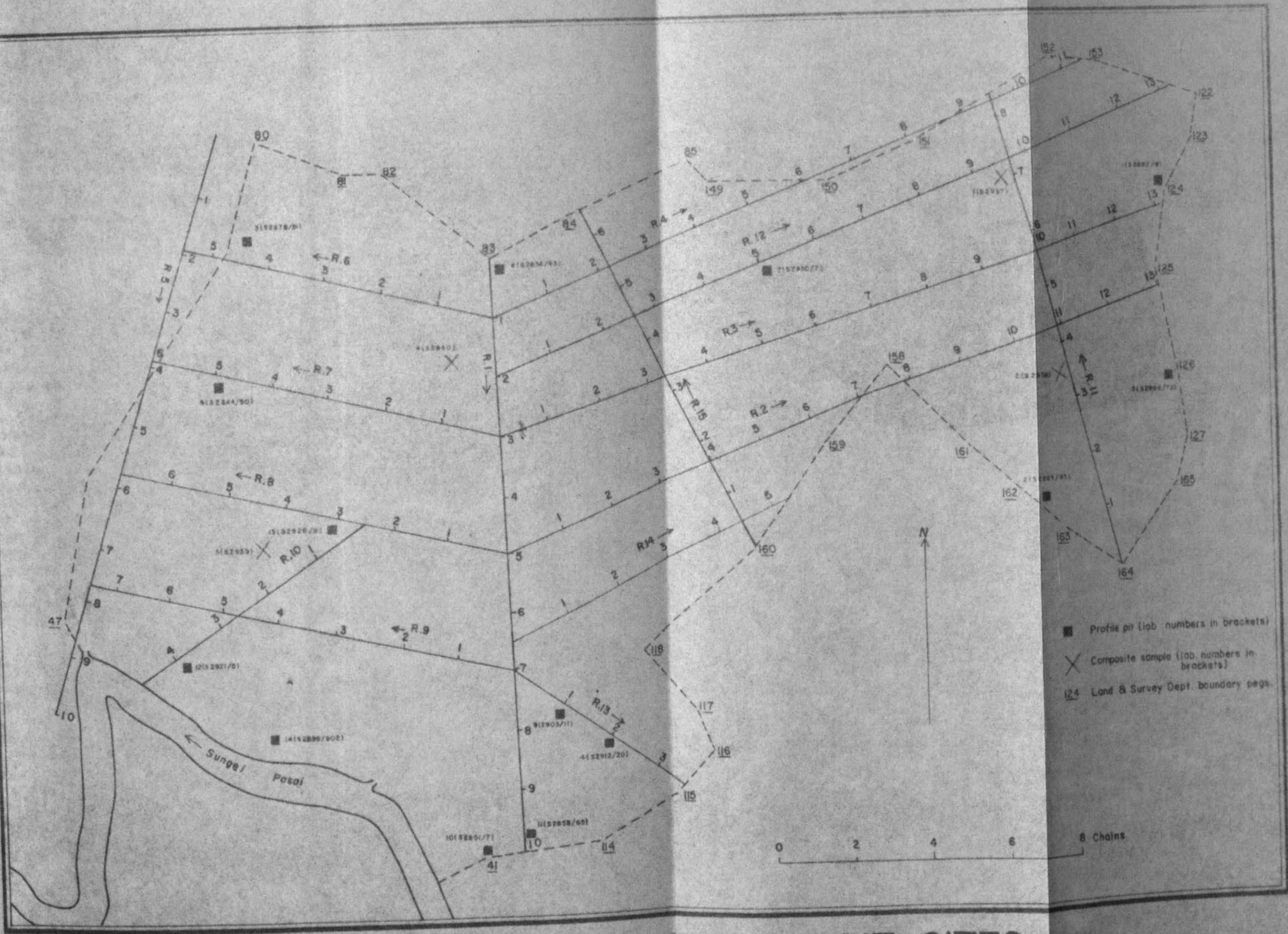


Fig. 4: RENTISES AND PROFILE PIT SITES

The most widespread profile form developed in the upland soils, therefore, is a yellowish brown clay or clay loam grading downwards into a somewhat heavier-textured and generally more reddish-coloured zone, the latter overlying or incorporating gravelly material such as that described above. The gravel zone may be only a few

The purpose of the present survey is to assist in planning development of the Station and it is to be hoped that future work on the Station will throw light on the agricultural status of the soils described above. Experimental data is almost totally lacking at the present time. It would serve little purpose to go into the question of agricultural potential in detail before an experimental programme has been drawn up but some general points can usefully be made.

1) From previous work at a reconnaissance level in this part of Third Division (4,5) it can be said fairly safely that the upland soils of the survey area are representative of many parts of Third Division where similar topography is found. (On the more steeply dissected topography widespread in the east of the Division and in many parts of the Lower Rejang much shallower soils than those described above tend to be dominant.) From this viewpoint, therefore, the site is suitable for an Agricultural Station.

2) Of the alluvial soils only Malang Series is sufficiently extensive to allow any experimental work. This series is representative of an important Family of alluvial soils, found over a wide area in this and other Divisions.

3) None of the soils are chemically rich. From 'Reserve' determinations it appears that only K is present in satisfactory amounts (except in Siong Series). It is probable that most crops will respond to balanced fertilizer dressings on all soils, phosphatic additives being particularly necessary.

4) Likau Series appears similar to light-textured sandstone-derived soils in Fourth Division on which there is a considerable erosion hazard. If this soil is cleared and planted this factor particularly must be borne in mind.

5) The area surveyed is very small but a number of Soil Series are present within it. This is typical of many areas underlain by Belaga II and Belaga III geology. The considerable variety of soils present on the flanks of one hill can be seen easily when driving along the Sibu-Ulu Oya Road where road cuttings are still fresh. In laying out any experimental plots the study is complicated if the plot covers more than one soil, but it should be remembered that if the project is leading to large scale plantings outside the station it will probably be impossible to avoid including a wide range of soils within such a planting in many if not most localities. Depending on their ultimate purpose, therefore, experimental projects on the station need not, of necessity, be sited within one of the units on the soil map.

SOIL CLASSIFICATION.

The classification of Sarawak Soils is receiving considerable attention at the present time and ideas are by no means fixed.

The majority of upland soils (Pasai, Lutong and Likau Series) are classed in the Great Soil Group of Red-Yellow Podsollic Soils. This Group includes soils of a generally red or yellow colour in which there is marked horizon differentiation due to podsollic processes. These processes are expressed in a textural B2 horizon with blocky structure and deposition of iron and aluminium to a variable extent. They are generally acid and contain few primary minerals other than quartz.

Siong Series is difficult to place in the classification. There are many similar soils exhibiting the features found in this Series and it would appear that a new Great Soil Group to cover such tropical podsollic soils is needed.

Of the lowland soils Malang Series is provisionally considered as an intergrade between the Great Soil Groups of Alluvial Soils and Groundwater Laterite Soils. Semilajau Series is classified as an Alluvial Soil. Bog Soils - Anderson Series - are locally present in the survey area.

Below the Great Soil Group level soils are classified in Sarawak into Soil Families. The Family classification is in its early stages at the present time and, with the exception of those Series classified in the Semongok Family, which has been fairly well characterised, Family classification is not attempted for the Series described below.

DESCRIPTION OF THE SOIL SERIES

In this section each series is described and its range of characteristics given. While many of the soils in this area have been encountered elsewhere they have, in all but a few cases, not been studied at a detailed level of survey and series names have not therefore been set up. As the area covered by this survey is very small it is probable that only a part of the range acceptable under the series definition is represented. The ranges described must thus be taken as applying only to the present survey area and may be extended when the same soils are studied at a detailed level in other localities. Where series are provisional, code numbers have not been allocated to them.

PASAI SERIES (code number -).

Pasai series has been classified in the Semongok Family in the Great Soil Group of Red-Yellow Podsollic Soils.

The series comprises yellow to reddish yellow sandy or fine sandy clays, mottled below the surface horizons, which are derived from mixed shale and sandstone parent rock. There is a distinct zone of iron accumulation, a textural B horizon being present but not well marked.

General description.

The following general profile description covers the most frequently encountered range of characteristics.

- | | |
|-------------------|--|
| 0 - 2 to 6 inches | Yellow to dark greyish brown loam to fine sandy clay. Friable to slightly firm. Little or no structure. Well-rooted. |
| - 12 to 36 " | Yellow to reddish yellow sandy clay loam to fine sandy clay, faintly or distinctly mottled with greys and yellows. Firm. Weak blocky structure. Sparsely rooted. |
| - 48 " | Reddish yellow to red fine sandy or sandy clay, mottled as above. Firm. Structure as above, sometimes more strongly developed. Sparsely rooted. Gravel-size pieces of altered rock commonly present at the base of this horizon or scattered through it. |

0"-

A1

12"-

A2

24"-

B21

Reddish yellow
clay.

36"-

B22

Many fragments of
iron-enriched
weathered rock.

48"-

60"-

B3

PLATE I: PASAI SERIES

Range of characteristics

Parent material: highly weathered shales with subordinate sandstones of the Belaga III Formation, which is Tertiary in age. Sufficient sandstone is present in the underlying rock mantle to give an appreciable amount of sand or fine sand in the subsoil mineral fraction but the C horizon where exposed is usually entirely argillaceous.

Topography: varied but generally moderately to steeply rolling. The series occurs on rounded summits with very gentle slopes and also on steep lower slope sites of up to 35°.

Occurrence: unknown at present, the series having been established on the present survey. Work at a reconnaissance level elsewhere suggests, however, that this series - or similar series within the same Family - is an important soil along much of the Sibu-Ulu Oya road and probably also in many parts of the Lower Rejang area where this geological Formation is present and the topography is not too dissected.

Diagnostic horizons: within 48 inches of the surface the following genetic horizons are present:

- A1 - rarely more than 3 inches and commonly destroyed by cultivation.
- A2 - up to 2 feet in thickness but may be only weakly expressed.
- B - distinct although the transition from the A2 horizon may be wide.

The C horizon in the survey area was consistently beyond augering depth, although sometimes reached in profile pits.

Colour: below the humus-stained A1 horizon, colours range from the 5YR hue to the 10YR hue. The A2 horizon is yellow to reddish yellow, rarely strong brown. The B horizon ranges from reddish yellow to red. Both the A2 and the B horizons are mottled. In the A2 horizon mottles are few to many, fine (sometimes medium) and variable in colour. A mixture of light grey and strong brown is common. Pale yellow and reddish yellow mottles also occur. In the B horizon inclusions of iron-enriched weathered rock fragments are often many and may be locally dominant. They are coloured red, purple or black.

Texture: variable in the A1 horizon. Fine sandy loams to sandy clays were recorded on the survey. In the A2 horizon the texture ranges from sandy clay loam to sandy clay, in the B horizon from sandy clay to fine sandy clay.

Structure and consistence: in the moist state the soil normally shows a weak, coarse subangular blocky structure, sometimes barely present in the A2 horizon. The topsoil is usually structureless under the range of conditions in the survey area. Topsoils are friable to slightly firm, subsoils firm to very firm.

Inclusions: in or near the base of the B horizon a 'stoneline' of altered gravel-size rock fragments (as described under 'colour') is usually a feature of the profile. In some profiles quartz gravel is also present in this position.

Drainage: internal drainage is imperfect. External drainage is rapid to very rapid.

Rooting depth: below the surface 3 inches roots are few in number but some are usually present throughout the 0 - 48 inch profile. The gravel zone does not form an impediment to main roots.

Phases: an imperfectly drained phase has been established.

Chemical and mineralogical features.

Clay minerals: No data

Other mineralogical data: None

Silica/sesquioxide ratios: No data

Sesquioxide ratios: No data

Cation exchange capacity: Over 6 in the A1 horizon, 3.7 - 7.1 in the subsoil, highest in the B horizon (from one profile).

Base saturation: No data.

Acidity: 3.5 - 5.2 rising in the B horizon.

'Reserve' Phosphorus in ppm: 80-160 in the topsoil, 50-110 in the subsoil.

'Reserve' cations in ppm: Calcium - very variable (20-350) in the topsoil, 120-150 in the subsoil

Magnesium - very variable (240-1500) in the topsoil, 700-1500 in the subsoil.

Potassium - 1500-4000 in the topsoil, similar range in the subsoil, but an increasing trend with depth.

Group III: 3-8% in the topsoil rising to 18% in the subsoil.

LUTONG SERIES (code number -)

Lutong series, is classified in the Semongok Family of the World Great Soil Group of Red-Yellow Podsollic Soils.

The series is characterised by gley mottles throughout the subsoil and by a distinct textural B horizon. The soil is heavier in texture than Pasai Series, with which it is associated.

General description.

The following profile is typical of the survey area:

- | | |
|-------------------|--|
| 0 - 3 to 6 inches | Greyish brown to dark brown clay loam to clay. Structureless. Friable. Well rooted. |
| - 12 to 24 " | Brown to strong brown clay loam to clay, with many distinct mottles. Weak blocky structure. Firm. Sparsely rooted. |
| - 48 " | Reddish yellow to red clay, with many distinct mottles. Structure as above, perhaps stronger. Sparsely rooted. Gravel size pieces of altered rock often present at the base of this horizon or incorporated in it. |

Range of characteristics

Parent material: Highly weathered shales of the Belaga III Formation (Tertiary). If bands of sandstone are present they are sufficiently thin or scattered in the parent rock to contribute very little sand to the mineral fraction of the subsoil.

Topography: Varied, ranging from gently to steeply rolling. The series is encountered on all sites from summit to lower slope. It may occupy lower slopes where the associated summits and upper slopes are mantled by soils derived largely from sandstone.

Occurrence: The series was established on this survey. Bedup series, a similar soil on Triassic shale is widespread in First and Second Division.

Diagnostic horizons: Within 48 inches of the surface the following genetic horizons are present:

- A1 - perhaps up to 6 inches in thickness but may be very thin or destroyed by cultivation
- A2 - variable in thickness but usually distinct
- B - distinct although the transition from the A2 horizon is sometimes wide.

The C horizon, assumed to be a pale-coloured dense clay from weathered shale, was consistently beyond augering depth in the survey area and was not encountered in profile pits.

Colour: Ranges from the 5YR to the 10YR Hue. Below the dark-coloured humus-stained A1 horizon the matrix colour is yellowish brown to strong brown, trending to reddish yellow or red in the B horizon. The A1 horizon is usually unmottled, although faint mottling may be present. Throughout the subsoil mottles are many, distinct, fine to large and dominantly light grey or pale yellow in colour. Some reddish yellow mottles may also occur. Where fragments of altered weathered rock are present in the B horizon they are usually red, purple or black.

Texture: Variable in the A1 horizon, both clay loams and clays have been recorded; in the A2 horizon usually clay loam, although clay in some profiles; in the B horizon invariably clay; sandy clays, by definition, are not found in this series.

Structure and consistence: The A1 horizon is usually structureless or very weakly blocky or coarse granular. The A2 and B horizons have a coarse subangular blocky structure weakly developed, although generally stronger in the B horizon than in the A2. In the moist state structure in the A2 horizon may be hardly discernible.

Inclusions: In or near the base of the B horizon a 'stoneline' of altered gravel-size rock fragments (in which sandstone may be included, although the soil is otherwise not derived from this rock type) is a common feature of the profile.

Drainage Internal drainage is imperfect. External drainage is rapid to very rapid.

Rooting depth: Below the A1 horizon roots are usually few in number but there is little impediment to rooting within the 0 - 48 inch layer unless the gravel zone is well-developed and, in the latter case, this can be penetrated by main roots.

Phases: No phase distinctions have been made.

Chemical and mineralogical features

Clay minerals: No data

Other mineralogical data: None

Silica/sesquioxide ratios: No data

Cation exchange capacity: 9-11 in the A1 horizon, dropping to 3.5 in the subsoil (from one profile).

Base saturation: No data

Acidity: 3.5-4.3, rising slightly in the B horizon.

'Reserve' Phosphorus in ppm: 90-210 in the topsoil, 80-110 in the subsoil.

'Reserve' cations in ppm: Calcium - 200-360 in the topsoil, 60-350 in the subsoil.

Magnesium - 90-260 in the topsoil, 230-1000 in the subsoil.

Potassium - 1600-4200 in the topsoil and upper subsoil, 4500-7000 in the lower subsoil.

Group III elements: 3-6% in the topsoil, rising to 10-30% in the lower subsoil.

LIKAU SERIES (code number -)

Likau series, established in Fourth Division, has been classified in the Great Soil Group of Red-Yellow Podsollic Soils.

The series comprises yellow sandy clays derived from Tertiary sandstone (or a mixture of sandstone and shale in which the former is dominant). Translocation of clay and iron is discernible but not pronounced. It appears that profiles in this area are rather deeper than in that from which the series was first described. The characteristics given below apply to the survey area unless otherwise stated.

General description

The following general profile description covers the most frequently encountered range of characteristics in this survey area:

0 - 2 to 3 inches	Greyish brown to very dark greyish brown sandy clay loam. Structureless. Loose. Well-rooted.
- 48 "	Yellowish brown sandy clay, becoming slightly heavier with depth and in places sandy clay loam above 24 inches. May be faintly mottled. Weak, coarse blocky structure, becoming slightly stronger with depth. Friable to firm. Sparsely rooted.

Range of characteristics

Parent material: Well-weathered Tertiary sandstone or a shale/sandstone complex in which sandstone is dominant.

Topography: Varied but generally moderately to steeply rolling. The series may be found on rounded and rather flat summits, but also on steep lower slopes of 30-35°. It is generally associated with somewhat higher hills than those mantled by Pasai series, a soil with which it occurs, or on ridge lines where Pasai series occupies the lower slopes.

Occurrence: Established in Fourth Division and probably widespread where the topography and parent rock described above is found.

Diagnostic horizons: Within 48 inches of the surface in this area the following genetic horizons are present:

- A1 - usually thin and sometimes destroyed by cultivation
- A2 - } variable in thickness. The change generally indistinct
- B - } and very gradual.

In Fourth Division the change from the A2 horizon to the B horizon is more distinct, the former commonly being quite marked. Shallower soils are commoner there also, a C horizon being present within the 0 - 48 inch zone at many sites.)

0"

A1

12"

24"

36"

48"

Uniform
yellowish-brown
fine sandy clay.

Strong brown
mottled fine
sandy clay.

PLATE 2: LIKAU SERIES

Colour: The subsoil is yellowish brown in the 10YR hue throughout, although possibly trending towards strong brown near 48 inches. The A1 horizon is darker in colour. Yellow or brownish yellow mottling may be present in the subsoil but rarely above 18 inches and always faint.

Texture: In the topsoil variable but usually fine sandy or sandy clay loam; in the subsoil generally sandy clay, perhaps sandy clay loam above 18 inches. The texture becomes gradually heavier with depth.

Structure and consistence: Little or no structure in the topsoil.

Weak, coarse subangular blocky structure in the subsoil, becoming stronger with depth. A variable consistence in the topsoil, friable in the subsoil, sometimes becoming firm with depth.

Inclusions: None encountered in profiles examined to 48 inches although in one profile pit (profile 6) a quartz stoneline was present below 70 inches. Elsewhere such a stoneline may be present at a shallower depth.

Drainage: Internal drainage is good. External drainage is rapid.

Rooting depth: The subsoil is generally not well-rooted but there is no impediment to roots in the top 5 feet of profiles examined.

Phases: The soils in this area are provisionally described as a deep phase, in order to distinguish them from profiles previously encountered in Fourth Division.

Variant: a small occurrence of soils was noted in which textures are sandy loam to sandy clay loam and mottling is stronger than in the series as described above. The soil occupies a lower slope position and is a colluvial associate of Likau series. It is provisionally classified as a variant of the latter.

Chemical and mineralogical features

Clay minerals: No data

Other mineralogical data: None

Silica/Sesquioxide ratios: No data

Cation exchange capacity: 10-13 in the topsoil, 3-5 in the subsoil (from one profile)

Base saturation: No data

Acidity: 3.8-4.8

'Reserve' Phosphorus in ppm: 150-200 in the topsoil, 50-100 in the subsoil.

'Reserve' cations in ppm: Calcium - 150-210 in the topsoil, 90-350 in the subsoil

Magnesium - 300-600 in the topsoil,
300-900 in the subsoil.

Potassium - 1000-1600 in the topsoil,
1200-3200 in the subsoil

Group III elements: 2-10% in the topsoil, 6-15% in the subsoil.

SIONG SERIES (code number -)

Siong series is classified in the Great Soil Group of Podsollic Soils.

It is a pale-coloured, highly leached, coarse-textured soil, believed to be a residual soil on very quartzose rocks. It may, however, be developed in old alluvial terrace material.

0"

12"

24"

36"

48"

60"

72"



Al

Greyish brown to light
grey sandy loam,
increasingly mottled
with depth.

Stoneline of quartz
gravel.

Stoneline of iron-
enriched well-weathered
rock fragments.

PLATE 3: SIONG SERIES

General description.

The series is very restricted in extent and, while typical of the survey area, the profile described below may not be modal for the series as a whole.

0 - 2 to 6 inches	Greyish brown sandy loam. Structureless. Loose. Well-rooted.
- 24 to 48 "	Greyish or light greyish brown sandy loam to sandy clay loam, faintly mottled, becoming distinctly so at depth. Structureless. Friable. Sparsely rooted.
below 24 to 48 "	Light grey mottled sandy clay loam. Structureless. Friable. Bands and intermittent patches of quartz gravel and/or weathered shale fragments. Sparsely rooted. <u>Grading</u> to non-gravelly clay from weathered shale.

Range of characteristics.

Further investigation of this series elsewhere in Sg. Pasai area may lead to considerable modification of remarks in this section.

Parent material: uncertain but believed to be highly weathered shales with numerous quartz veins. It may, however, be partly or wholly derived from old terrace alluvium.

Topography: The series is located on summits and upper slopes of a gently rising hill (less than 25° on all slopes) near the Sg. Pasai. The summit is at about 30 feet above the present floodplain.

Occurrence: The series was established on the survey. Similar soils have been noted in many other parts of the general area covered by reconnaissance work and this series may therefore be extensive outside the survey area.

Diagnostic horizons:

A1	- usually thin but quite distinct.
A2	- may extend to below 48 inches.
B	- only weakly developed and may not appear above 48 inches.

A C horizon was noted in profile pits but not encountered within augering depth.

Colour: Below a greyish brown A1 horizon, the subsoil is light brownish grey to light grey in the 2.5Y Hue. Mottles are faint but many and become distinct with increasing depth. Where a B horizon is found within augering depth it may be marked by distinct reddish brown mottles. Elsewhere in the subsoil mottles are light grey or pale yellow. Red and black weathered rock fragments may be present in the lower subsoil.

Texture: Sandy loam in the A1 horizon and in the upper part of the A2, becoming sandy clay loam with depth. The change is gradual with an ~~abrupt~~ textural break to clay in the C horizon. The latter has so far, however, only been noted below augering depth in profile pits.

Structure and consistence: The profile is structureless throughout. Topsoils are loose, subsoils friable.

Inclusions: the A1 and A2 horizons are generally non-gravelly, although scattered quartz gravel may occur in the lower part of the latter. At the base of the A2 horizon a zone of quartz gravel accumulation may be found, in places as a continuous horizon, elsewhere in isolated pockets or lenses. Gravel-size fragments of iron-enriched weathered shale or sandstone may also occur in this position but in less abundance than the siliceous material.

Drainage: Internal drainage is imperfect. External drainage is moderately rapid to rapid.

Rooting depth: The soil is sparsely rooted below the A1 horizon but there is no barrier to root penetration above the gravel zone which rarely occurs above 40 inches and is usually found at a much deeper level.

Phases: no phase differences have been mapped.

Chemical and mineralogical features.

Clay minerals: No data

Other mineralogical data: None

Silica/Sesquioxide ratios: No data

Sesquioxide ratios: No data

Cation exchange capacity: No data

Base saturation: No data

Acidity: 4.0 - 4.8

'Reserve' Phosphorus in ppm: 30-180 in the topsoil, 20-60 in the subsoil

'Reserve' cations in ppm: Calcium - 470-2300 in the topsoil, 60-320 in the subsoil, fluctuating rapidly down the profile.

Magnesium - 80-600 in the topsoil, 130-1100 in the subsoil although one subsoil sample gave 40.

Potassium - 1000-1300 in the topsoil, 1200-2000 in the subsoil.

Group III elements: 1-3% in the topsoil, 2-6% in the subsoil, increasing down the profile.

MALANG SERIES (code number 4305)

Malang series is provisionally considered to occupy an intergrade position between the Great Soil Groups of Alluvial Soils and Groundwater Podzols. — Lat?

The series is a brownish yellow alluvial clay, increasingly mottled at depth.

General description

The following profile is that most commonly encountered in this survey area:

0 - 1 to 2 inches	Yellowish to dark yellowish brown clay. Structureless to weakly medium subangular blocky. Firm. Well-rooted.
- 15 to 36 "	Yellowish brown clay, possible faintly mottled. Medium subangular blocky structure. Firm. Sparsely rooted.
below 15 - 36"	Mottled grey horizon. Structure as above.

Range of characteristics.

Parent material: Recent alluvium derived largely from shale.

Topography: Alluvial flats with less than 2° slope.

Occurrence: Widespread in all Divisions.

0"

Thin humus
staining

12"

Faintly mottled
or unmottled
well-structured.

24"

Strongly
mottled.

Perched
water table.

Plate 4: MALANG SERIES

Diagnostic horizons:

- Al - may be thin or absent
- 2 - a weakly gleyed horizon
- 3 - a strongly gleyed horizon, sometimes below auger depth

Colour: The thin Al horizon is barely darker in colour than the subsoil. The latter is yellowish brown to brownish yellow in the 10YR Hue above the gley horizon. Faint fine pale yellow and light grey mottles may be present and become many with depth. Light red and reddish yellow mottles may be present in the dominantly light grey horizon.

Texture: Clay throughout, in some profiles bordering on silty clay.

Structure and consistence: Subangular blocky throughout, although only weakly developed in the moist state and may not be apparent in the Al horizon in such conditions. Slightly firm in the Al horizon, firm in lower horizons.

Inclusions: No concretions, river-borne gravel or rock fragments were recorded in profiles examined. Such inclusions are acceptable within the series.

Drainage: The water table is within 2-4 feet of the surface during the rainy season and the soil is briefly flooded after heavy rain. External drainage is slow.

Rooting depth: Some roots were noted throughout both profile pits examined (dug to depths of 47 and 59 inches respectively), the level of the water table being the main limit to root extension.

Phases: No phases separations have been made.

Chemical and mineralogical features.

Clay minerals: No data

Other mineralogical data: None

Silica/Sesquioxide ratios: No data

Cation exchange capacity: Over 18 in the surface horizon, dropping to 8.8 at depth (one profile)

Base saturation: No data

Acidity: 3.8 - 5.0

'Reserve' phosphorus in ppm: 250 - 450 in the topsoil, 160-200 in the subsoil.

'Reserve' cations in ppm: Calcium - 210-270 in the topsoil, 160 - 240 in the subsoil.
Magnesium - 1000-2000 in the topsoil, 800 - 1500 in the subsoil
Potassium - 3000-5000 in the topsoil, 2700-4600 in the subsoil.

Group III elements: Variable between 6 and 14%.

SEMILAJAU SERIES (code number 4311)

Semilajau series is classified in the Great Soil Group of Alluvial Soils. The series was established in Fourth Division (Luak)

It is a light textured levee soil patchily present in this survey area along the bank of the Sg. Pasai.

General description.

Only one profile was examined closely on this survey (Profile 14). The following description summarises its main features:

0 - 3 inches	Strong brown loam. Structureless. Very friable. Well-rooted.
- 45 "	Yellowish brown loamy sand. Structureless. Very friable. Sparsely rooted.
below 45"	Yellowish to dark yellowish brown fine sandy loam, faintly mottled. Non-sticky. Nonplastic. Sparsely rooted.

Range of characteristics:

Parent material: Recent riverine alluvium.

Topography: Flat or gently sloping levee sites.

Occurrence: Probably widespread in the country

Diagnostic horizons:

- A1 - weakly developed and may be absent
- 2 -) broad transition from non-gleyed to
- 3 -) weakly gleyed subsoil horizons. Gleying does not necessarily occur within the profile.

Colour: Yellow or yellowish brown in the 10YR Hue below a slightly darker A1 horizon. The profile is largely unmottled except where clayey bands occur (see texture) or at depth.

Texture: Dominantly light-textured, ranging from sandy loam to course sand. The profile may, however, be stratified and bands of clay loam or clay present. Such stratification was not noted in this survey area within augering depth nor in the one profile pit examined.

Structure and consistence: Structureless throughout. Loose to friable, perhaps slightly firm in clayey horizons, if the latter are present.

Inclusions: Small bands of quartz gravel would be acceptable within the series but have not been recorded.

Drainage: Well-drained to excessively-drained in the 0-48 inch zone. External drainage is good to rapid except when local river levels are high.

Rooting depth: Good, although the profile is sparsely rooted as a rule.

Phases: No phase separations have been made.

Chemical and mineralogical features.

Clay minerals: No data

Other mineralogical data: None

Silica/sesquioxide ratios: No data

Sesquioxide ratios: No data

Cation exchange capacity: No data

Base saturation: No data

Acidity: 3.7 in the surface horizon, 4.6-4.8 at lower depths (one profile)

'Reserve' Phosphorus in ppm: 80-220 in the topsoil, 80-120 in the subsoil (one profile).

'Reserve' cations in ppm: Calcium - 40-120 in the topsoil, 120-360 in the subsoil

Magnesium - 300-1000 in the topsoil, 300 to 510 in the subsoil

Potassium - 1900-4100 in the topsoil, 1800-3300 in the subsoil.

(All data from one profile).

Group III elements: 2-6% variable through the profile.

ANDERSON SERIES (code number 5001)

Anderson series is the type series within the Anderson Family, in the Great Soil Group of Bog Soils. The series covers a very small area here.

Anderson series includes soils developed in freshwater peat swamps, where a variable thickness of raw peat has accumulated over the mineral 'soil.' The peat is characteristically poor in bases and has a high C/N ratio. Water tables are at the surface through most of the rainy season and generally fairly close to the surface in the dry season.

Three phases have been separated, based on the depth to mineral horizons:

- Phase 1 : 3-6 feet of peat
- Phase 2 : 6 - 10 feet of peat
- Phase 3 : more than 10 feet of peat

Where less than 6 inches of peat has developed the soil is classed as a peaty phase of a series within the Group of Low-Humic Gley Soils; where peat is 6 inches to 3 feet in thickness the soil is classed in the Group of Half-Bog Soils.

Phases 1 and 2 of Anderson series were recorded in this area but depths were found to be so variable that it is possible that Phase 3 also occurs.

OTHER ALLUVIAL AND HYDROMORPHIC SOILS

In gullies, minor depressions and on the fringes of the main bottomlands profiles not covered by the series described above were recorded at some augering points. It is not proposed to set up series names for these soils as they cover very limited areas and are of very little interest to agriculturalists. Where series classification is required for such soils, they are best referred to series already established in areas where the latter cover a sufficient acreage for their range of characteristics to be adequately studied. On the present survey these very minor soils have been grouped under one mapping unit.

Three main types of soil are grouped in this unit:

- (1) less than 3 feet of peat or muck over strongly hydromorphic clay
- (2) grey or mottled hydromorphic clay
- (3) grey or white sands or coarse sands.

The first type is mainly found in association with Anderson series, the second in minor gullies. The third type was noted in association with Semilajau series.

PART III

FORMAL PROFILE DESCRIPTIONS

In this section fourteen profiles dug at representative sites on the main soil series in the area are described in detail. In the case of the most widespread soils more than one profile of the series is described to illustrate some of the variations found within the classification unit. The full range of characteristics is not covered by these examples but has been set down in Part II of the report.

Data on 'reserve' cations are given for each profile. It has been found that these data are more useful in characterising the natural fertility of the soil for agriculture than 'exchangeable' determinations, which are almost invariably too low to show contrasts or allow comparative interpretations.

Profile 1.Soil Group: Red-Yellow PodsollicFamily: SemongokSeries: PASAIPhase: Imperfectly drained.Location: Oya Rd. Agricultural
Station boundary peg 124.Latitude: 2° 19' NLongitude: 112° 3' ETopography: Moderately rollingSite: Upper slopeSlope: 10°Parent material: Weathered Tertiary
shale and sandstone (Belaga III)External drainage: RapidVegetation/Land Use: Old secondary forestAltitude: c. 175 feet above sea level.Rainfall: c. 126 inches.Rainfall Class (Mohr): ILab. Nos: S2882 - S2888Field Nos: S321 - S327Date sampled: 13.4.64

- 0 - 4 inches Strong brown (7.5YR 5/8) fine sandy clay. Wet. Structureless. Nonsticky. Nonplastic. Many roots and rootlets. Porous. Distinct wavy boundary. (S2882)
- 4 - 11 " Reddish yellow (5YR 6/6) clay to fine sandy clay, with few faint fine and medium strong brown and light grey mottles. Moist. Structureless. Firm. Many rootlets. Porous. Diffuse wavy boundary. (S2883)
- 11 - 24 " Reddish yellow (5YR 6/8) clay to fine sandy clay, with many distinct medium and coarse light grey and pale yellow mottles. Moist. Weak coarse subangular blocky structure. Firm. Rare rootlets. Porous. Diffuse wavy boundary. (S2884)
- 24 - 36 " Reddish yellow (5YR 6/8) clay to fine sandy clay, with many faint fine pale yellow mottles. Moist. Weak medium subangular blocky structure. Firm, Rare rootlets. Porous. Diffuse wavy boundary (2885)
- 36 - 52 " Reddish yellow (5YR 6/8) clay, with profuse distinct fine and medium pale yellow mottles. Moist. Structureless. Slightly firm to firm. Abundant small angular fragments of iron-enriched weathered shale. Few medium and fine quartz gravel. No roots seen. Slightly porous. Diffuse wavy boundary (S2886)
- 52 - 59 " Reddish yellow (5YR 6/8) clay, with profuse distinct fine light grey and pale yellow mottles. Moist. Structureless. Firm. Many medium and coarse quartz gravel. Many small fragments of iron-enriched weathered shale. Very rare rootlets. Slightly porous. Diffuse wavy boundary. (S2887)
- 59 - 71 " Reddish yellow (5YR 6/8), red (2.5YR 4/8) and very pale brown (10YR 8/4) clay. Moist. Structureless. Firm. Few medium quartz gravel. Few small fragments of iron-enriched weathered shale. Very rare rootlets. Slightly porous. (S2888).

Laboratory number	2882	2883	2884	2885	2886	2887	2888
Upper depth of horizon (ins.)	0	4	11	24	36	52	59
Lower depth of horizon (ins.)	4	11	24	36	52	59	71
Horizon							
<u>PHYSICAL</u>							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
<u>CHEMICAL</u>							
pH (H ₂ O; 1:2.5)	4.0	4.4	4.6	4.9	5.2	4.8	4.9
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium							
Magnesium							
Potassium							
Sodium							
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)							
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	159	69	99	109	55	89	89
Potassium	3775	2850	2935	4200	3810	6250	7650
Calcium	330	120	160	130	150	180	500
Magnesium	815	869	821	1114	994	1480	1000
Iron							
Aluminium							
Group III Elements	7.8	7.6	8.4	13.6	12.8	16.9	18.0
Sulphates (Morgan's)							
Nitrogen (%)	0.24	0.08	0.06				
Organic Carbon (%)	2.70	0.48	0.29				
C/N Ratio.	11	6	5				

Table 1: Analytical data. Pasai Series (Profile 1)

31.

Profile 2.

Soil Group: Red-Yellow Podsollic

Family: Semongok

Series: PASAI

Phase: Imperfectly drained

Location: Oya Rd. Agricultural
Station, near boundary peg 163

Latitude: 2° 19' N

Longitude: 112° 3' E

Topography: Moderately rolling

Site: Lower slope.

Slope: 32°

Parent material: Weathered Tertiary
shale and sandstone (Belaga III)

External drainage: Rapid

Vegetation/land use: Old secondary forest

Altitude: c. 100 feet above sea level.

Rainfall: c. 126 inches

Rainfall Class (Mohr): I

Lab. Nos: S2889 - S2895

Field Nos: S313 - S319

Date sampled: 13.4.64

- 0 - 3 inches Yellowish brown (10YR 5/4) fine sandy loam. Moist. Structureless. Friable. Many roots and rootlets. Porous. Distinct wavy boundary. (S2889).
- 3 - 13 " Reddish yellow (5YR 6/6) fine sandy clay loam, with many faint fine light grey and reddish yellow mottles. Moist. Structureless. Firm. Rare rootlets. Porous. Diffuse wavy boundary. (S2890).
- 13 - 21 " Reddish yellow (5YR 6/6) fine sandy clay, with many distinct fine and medium light grey and reddish yellow mottles. Moist. Structureless. Firm to very firm. No roots seen. Porous. Diffuse wavy boundary. (S2891).
- 21 - 31 " Reddish yellow (5YR 6/8) fine sandy clay, with many distinct fine light grey mottles and many distinct medium strong brown mottles. Moist. Weak coarse subangular blocky structure. Firm to very firm. Very rare rootlets. Porous. Diffuse wavy boundary. (S2892)
- 31 - 53 " Red (2.5YR 4/8) fine sandy clay, with abundant distinct fine light grey, pale yellow and reddish yellow mottles. Moist. Structureless. Slightly firm. Abundant medium and coarse quartz gravel. Frequent small angular fragments or iron-enriched weathered shale and sandstone. Slightly porous. Distinct wavy boundary. (S2893)
- 53 - 63 " Reddish yellow (5YR 6/8), very pale brown (10YR 7/4) and white (2.5Y 8/0) clay. Moist. Structureless. Slightly firm. Few small fragments of weathered shale. Slightly porous. Diffuse irregular boundary. (S2894)
- 63 - 71 " Inclined bands of light grey, yellow, strong brown and reddish yellow well-weathered shale. Generally soft but includes thin bands of harder iron-enriched material. (S2895).

Laboratory number	2889	2890	2891	2892	2893	2894	2895
Upper depth of horizon (ins.)	0	3	13	21	31	53	63
Lower depth of horizon (ins.)	3	13	21	31	53	63	71
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	4.3	4.1	4.5	4.4	4.7	4.6	4.6
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium	49	49	55	43	61	25	61
Magnesium	8	22	4	4	11	4	tr
Potassium	41	25	25	26	55	46	58
Sodium	59	45	tr	45	63	52	45
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)	6.38	3.71	4.34	3.86	4.23	7.12	5.96
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	89	50	57	55	68	88	90
Potassium	2635	2800	3770	4400	5000	8000	7200
Calcium	20	90	120	120	150	120	120
Magnesium	240	359	773	737	934	1312	1216
Iron							
Aluminium							
Group III elements	4.3	4.6	7.2	9.0	17.5	11.1	11.1
Sulphates (Morgan's)							
Nitrogen (%)	0.21	0.04					
Organic Carbon (%)	2.30	0.25					
C/N Ratio.	11	6					

Table 2 : Analytical data, Pasai Series (Profile 2)

Profile 3Soil Group: Red-Yellow PodsollicFamily: SemongokSeries: PASAIPhase: Imperfectly-drained.Location: Oya Rd. Agricultural Station, rentis 13, peg 2Latitude: 2° 19' NLongitude: 112° 3' ETopography: Gently rollingSite: Upper slopeSlope: 15°Parent material: Weathered Tertiary shale (Belaga III) with quartz veins.External drainage: RapidVegetation/Land Use: 7 month old tapioca after hill padiAltitude: c.95 feet above sea level.Rainfall: c. 126 inchesRainfall Class (MOhr): ILab. Nos: S2911 - S2919Field Nos: S343 - S351Date sampled: 12.4.64

- 0 - 2 inches Dark greyish brown (10YR 4/2) fine sandy clay loam, with few faint fine yellow mottles. Moist. Structureless. Very friable. Many roots and rootlets. Few small charcoal fragments. Porous. Distinct irregular boundary. (S2911)
- 2 - 4 " Brown (10YR 5/3) fine sandy clay, with few faint medium and fine light grey mottles. Moist. Weak medium subangular blocky structure. Slightly firm. Few roots and rootlets. Porous. Distinct wavy boundary. (S2912)
- 4 - 12 " Light yellowish brown (2.5Y 6/4) fine sandy clay, with many distinct medium and coarse brown and light grey mottles. Moist. Weak medium subangular blocky structure. Firm. Rare rootlets. Porous. Indistinct wavy boundary. (S2913)
- 12 - 22 " Light yellowish brown (2.5Y 6/4) fine sandy clay, with many distinct medium and coarse brown and light gray mottles. Moist. Weak medium subangular blocky structure. Firm. Rare rootlets. Porous. Diffuse wavy boundary. (S2914)
- 22 - 33 " Light yellowish brown to pale yellow (2.5Y 6/4 - 7/4) fine sandy clay, with abundant distinct medium and coarse light grey and brown mottles. Moist. Weak medium subangular blocky structure. Firm. Rare rootlets. Slightly porous. Diffuse wavy boundary. (S2915)
- 33 - 41 " Pale yellow (2.5Y 7/4) fine sandy clay, with many distinct fine yellowish red mottles. Moist. Structureless. Firm. Abundant medium and coarse quartz gravel. Rare rootlets. Many light red patches of weathered shale. Slightly porous. Diffuse wavy boundary. (S2916)
- 41 - 48 " Pale yellow (2.5Y 7/4) fine sandy clay, with abundant prominent medium and coarse red mottles and many faint medium yellow mottles. Moist. Structureless. Firm. Many medium and coarse quartz gravel. No roots seen. Diffuse wavy boundary. (S2917)
- 48 - 56 " Pale yellow (2.5Y 8/4) clay with many faint fine and medium brownish yellow and light grey mottles. Moist. Structureless. Firm. Diffuse irregular boundary. (S2918).

Laboratory number	2912	2913	2914	2915	2916	2917	2918
Upper depth of horizon (ins.)	0	2	4	12	22	33	41
Lower depth of horizon (ins.)	2	4	12	22	33	41	48
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	3.4	3.6	3.8	3.7	3.8	3.9	3.9
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium							
Magnesium							
Potassium							
Sodium							
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)							
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	145	104	66	64	87	63	90
Potassium	1625	3050	2100	2195	3950	3045	5300
Calcium	170	250	130	120	110	220	240
Magnesium	1450	1785	419	485	815	605	761
Iron							
Aluminium							
Group III Elements	3.3	6.9	4.4	5.7	8.6	9.2	14.2
Sulphates (Morgan's)							
Nitrogen (%)	0.32	0.15	0.07				
Organic Carbon (%)	3.40	1.46	0.59				
C/N Ratio.	11	10	8				

Table 3 : Analytical data, Pasai Series (Profile 3)

56 - 62 "

Light grey (2.5Y 7/0 - 5Y 7/1) clay, streaked with thin yellowish brown bands. Moist. Structureless. Firm. (S2919)

Profile 3 is less well-drained than the other examples described. It occurs on the low hill in the south of the Station and grades laterally into Strong Series.

Station: U.S. Agricultural Station, near rentis 6, pag 46

Station: 2° 19' N

Station: 112° 3' E

Drainage: Moderately rolling

Top slope

35°

2-3 inches Dark grayish brown (10YR 4/3) fine sand clay loam. Moist. Structureless. Slightly firm. Many roots and rootlets. Porous. Distinct. Wavy boundary. (S2875)

4-6 " Yellow (10YR 7/6) fine sandy clay loam. Moist. Weak coarse subangular blocky structure. Firm. Few rootlets. Porous. Diffuse wavy boundary. (S2876)

8-12 " Yellow (10YR 7/8) fine sandy clay, with few distinct fine pale yellow mottles. Moist. Weak medium to coarse subangular blocky structure. Firm. Few rootlets. Porous. Diffuse wavy boundary. (S2877)

12-14 " Reddish yellow (7.5YR 7/8) fine sandy clay. Moist. Weak coarse subangular blocky structure. Firm. Few rootlets. Slightly porous. Diffuse wavy boundary. (S2878)

16-22 " Reddish yellow (7.5YR 6/8) fine sandy clay, with few faint fine yellow mottles. Moist. Weak coarse subangular blocky structure. Firm. Rare rootlets. Porous. Diffuse wavy boundary. (S2879)

24-32 " Reddish yellow (7.5YR 7/8) fine sandy clay, with many distinct fine yellow and light gray mottles and very distinct medium yellowish red mottles. Moist. Weak coarse subangular blocky structure. Firm. Rare rootlets. Porous. Diffuse wavy boundary. (S2880)

34-42 " Reddish yellow (7.5YR 7/8) fine sandy clay, with many distinct medium yellow, light gray and red mottles. Moist. Very weakly coarse subangular blocky structure. Firm. Few roots and rootlets. Porous. (S2881)

36.
Profile 4.

Soil Group: Red-Yellow Podsollic

Parent material: Weathered Tertiary shale
and sandstone (Belaga III).

Family:

External drainage: Rapid

Series: PASAI

Vegetation/Land Use: Cleared land,
recently burnt.

Phase: Imperfectly drained

Location: Oya Rd. Agricultural
Station, near rentis 6, peg 4 $\frac{1}{2}$

Altitude: c. 145 feet above sea level.

Latitude: 2° 19' N

Rainfall: c. 126 inches

Longitude: 112° 3' E

Rainfall Class (Mohr): I

Topography: Moderately
rolling

Lab. Nos: S2875 - S2881

Field Nos: S305 - S311

Site: Upper slope

Date sampled: 12.4.64

Slope: 25°

- 0 - 2 inches Dark greyish brown (10YR 4/2) fine sand clay loam. Moist. Structureless. Slightly firm. Many roots and rootlets. Porous. Distinct. Wavy boundary. (S2875)
- 2 - 8 " Yellow (10YR 7/6) fine sandy clay loam. Moist. Weak coarse subangular blocky structure. Firm. Few rootlets. Porous. Diffuse wavy boundary. (S2876)
- 8 - 19 " Yellow (10YR 7/8) fine sandy clay, with few distinct fine pale yellow mottles. Moist. Weak medium to coarse subangular blocky structure. Firm. Few rootlets. Porous. Diffuse wavy boundary. (S2877)
- 19 - 34 " Reddish yellow (7.5YR 7/8) fine sandy clay. Moist. Weak coarse subangular blocky structure. Firm. Few rootlets. Slightly porous. Diffuse wavy boundary. (S2878)
- 34 - 42 " Reddish yellow (7.5YR 6/8) fine sandy clay, with few faint fine yellow mottles. Moist. Weak coarse subangular blocky structure. Firm. Rare rootlets. Porous. Diffuse wavy boundary. (S2879).
- 42 - 58 " Reddish yellow (7.5YR 7/6) fine sandy clay, with many distinct fine yellow and light grey mottles and many distinct medium yellowish red mottles. Moist. Weak coarse subangular blocky structure. Firm. Rare rootlets. Porous. Diffuse wavy boundary. (S2880).
- 58 - 72 " Reddish yellow (7.5YR 7/6) fine sandy clay, with many distinct medium yellow, light gray and red mottles. Moist. Very weakly coarse subangular blocky structure. Firm. Few roots and rootlets. Porous. (S2881)

Laboratory number	2875	2876	2877	2878	2879	2880	2881
Upper depth of horizon (ins.)	0	2	8	19	34	42	58
Lower depth of horizon (ins.)	2	8	19	34	42	58	72
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	3.8	4.6	4.7	4.9	5.1	5.0	5.1
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium							
Magnesium							
Potassium							
Sodium							
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)							
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	110	54	48	39	65	41	44
Potassium	2200	2670	2400	2750	3310	2350	5060
Calcium	250	140	110	120	120	20	80
Magnesium	791	742	731	761	1024	988	1288
Iron							
Aluminium							
Group III Elements	6.4	7.7	8.2	9.0	10.5	8.0	14.7
Sulphates (Morgan's)							
Nitrogen (%)	0.27	0.09	0.05				
Organic Carbon (%)	4.07	0.82	0.40				
C/N Ratio.	15	9	8				

Table 4 : Analytical data, Pasai Series (Profile 4)

Profile 5.Soil Group: Red-Yellow PodsollicParent material: Weathered Tertiary shale
(Belaga III)Family: SemongokExternal drainage: RapidSeries: LUTONGVegetation/Land Use: Recently cleared
and burnt, not planted.Phase:Location: Oya Rd. Agricultural
Station, rentis 7 peg 5Altitude: c. 100 feet above sea levelLatitude: 2° 19' NRainfall: c. 126 inchesLongitude: 112° 3' ERainfall Class (Mohr): ITopography: Moderately rollingLab. Nos: S2844 - S2850Site: Upper slopeField Nos: S275 - S281Slope: 16°Date sampled: 11.4.64

- 0 - 1 inch Brown to dark brown (10YR 4/3) clay loam to clay. Wet. Structureless. Slightly sticky. Nonplastic. Many rootlets. Porous. Indistinct irregular boundary. (S2844)
- 1 - 6 inches Brown to dark brown (10YR 4/3) clay loam to clay. Wet. Structureless. Slightly sticky. Nonplastic. Many rootlets. Porous. Indistinct irregular boundary. (S2845)
- 6 - 12 " Strong brown (7.5YR 5/8) clay, with many distinct medium and coarse reddish yellow and light grey mottles. Moist. Weakly medium subangular blocky structure. Firm. Few rootlets. Porous. Distinct irregular boundary. (S2846).
- 12 - 20 " Reddish-yellow (7.5YR 6/8) clay, with many distinct medium and coarse light grey mottles. Moist. Medium to coarse subangular blocky structure. Firm. Few rootlets. Porous. Diffuse wavy boundary. (S2847)
- 20 - 30/36" Reddish yellow (5YR 6/8) clay, with many distinct fine light grey and light red mottles. Moist. Weakly coarse subangular blocky structure. Firm. Rare rootlets. Very rare small iron concretions. Porous. Distinct wavy boundary. (S2848)
- 30/36 - 48" Large and small weathered fragments of iron-enriched shale, sandy shale and sandstone in a matrix of yellowish red (5YR 5/8) clay, with many distinct fine and medium light grey mottles. No roots seen. Slightly porous. (S2849)
- 48 - 60" As above (S2850)

Laboratory number	2844	2845	2846	2847	2848	2849	2850
Upper depth of horizon (ins.)	0	1	6	12	20	30	48
Lower depth of horizon (ins.)	1	6	12	20	30	48	60
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	4.2	4.0	4.0	4.0	4.0	4.3	4.1
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium	189	68	44	56	56	80	19
Magnesium	51	0	0	0	0	0	0
Potassium	188	85	36	26	30	35	34
Sodium	40	41	29	33	32	33	30
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)	10.90	9.64	7.06	6.59	5.88	3.55	5.07
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	142	135	102	98	100	89	89
Potassium	3550	4100	4300	3250	4550	6300	4500
Calcium	340	200	100	110	60	350	270
Magnesium	90	240	234	294	407	180	1006
Iron							
Aluminium							
Group III Elements	8.2	7.8	8.0	7.1	10.5	30.4	26.0
Sulphates (Morgan's)							
Nitrogen (%)	0.21	0.18	0.08				
Organic Carbon (%)	2.70	2.07	0.52				
C/N Ratio.	13	12	7				

Table 5 : Analytical data, Lutong Series (Profile 5)

Profile 6Soil Group: Red-Yellow PodsollicParent material: Weathered Tertiary shale
(Belaga III)Family: SemongokExternal drainage: RapidSeries: LUTONGVegetation/Land Use: Secondary forest
with rubber and jak fruitPhase:Location: Oya Rd. Agricultural
Station, rentis 13, peg 1Altitude: c. 85 feet above sea level.Latitude: 2° 19' NRainfall: c. 126 inchesLongitude: 112° 3'E.Rainfall Class (Mohr): ITopography: Gently rolling.Lab. Nos: S2903 - S2911Site: Upper slope.Field Nos: S335 - S342 and S352Slope: 17°Date sampled: 12.4.64

- 0 - 2 inches Brown to dark brown (10YR 4/3) clay loam, with few faint fine pale yellow mottles. Moist. Structureless. Friable. Many roots and rootlets. Porous. Distinct smooth boundary. (S2903)
- 2 - 4 " Yellowish brown (10YR 5/4) clay, with many faint fine brown and light grey mottles. Moist. Structureless. Friable. Few rootlets. Porous. Distinct smooth boundary. (S2904)
- 4 - 8 " Yellow (10YR 7/6) clay, with many distinct medium light grey mottles. Moist. Weak medium subangular blocky structure. Firm. Few rootlets. Porous. Diffuse wavy boundary. (S2905)
- 8 - 16 " Yellow (2.5Y 8/6) clay, with many distinct coarse light grey mottles and many distinct fine and medium reddish brown mottles. Many rusty root channels. Moist. Weak coarse subangular blocky structure. Firm. Few rootlets. Porous. Diffuse wavy boundary. (S2906)
- 16 - 20 " Yellow (2.5Y 8/6) clay, with abundant distinct fine yellowish red mottles. Moist. Weak medium subangular blocky structure. Firm. Rare fine quartz gravel. Few rootlets. Porous. Diffuse wavy boundary. (S2907).
- 20 - 33 " Yellow (2.5Y 8/6) clay, with many faint fine reddish yellow and yellowish red mottles and few distinct medium light grey mottles. Moist. Medium subangular blocky structure. Firm. Few rootlets. Porous. Distinct wavy boundary. (S2908)
- 33 - 37 " Pale yellow (2.5Y 8/4) clay, with many faint fine and medium brown and light grey mottles. Moist. Structureless. Firm. Many medium and coarse angular quartz gravel. Few small fragments of well-weathered shale and sandstone. No roots seen. Porous. Distinct wavy boundary. (S2909)
- 37 - 52 " Light grey (2.5Y 7/0) clay, with many faint fine pale brown and light yellowish brown mottles. Moist. Structureless. Firm. Few medium and coarse angular quartz gravel. Few very small fragments of well-weathered shale and sandstone. Slightly porous. Diffuse wavy boundary. (S2910)
- 52 - 71 " Light grey (10YR 7/1) clay, with many red, strong brown and very pale brown lines and bands from weathered shale. Moist. Structureless. Firm. Few medium quartz gravel. (S2911)

	2903	2904	2905	2906	2907	2908	2909
Laboratory number							
Upper depth of horizon (ins.)	0	2	4	8	16	20	33
Lower depth of horizon (ins.)	2	4	8	16	20	33	37
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	3.9	3.5	3.7	4.0	4.0	4.1	4.0
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium							
Magnesium							
Potassium							
Sodium							
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)							
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	205	98	88	87	84	88	88
Potassium	1950	1650	2745	2150	2115	3300	6245
Calcium	360	330	100	110	200	80	190
Magnesium	258	144	413	515	437	940	946
Iron							
Aluminium							
Group III Elements	3.8	3.4	5.7	6.0	6.3	7.9	12.2
Sulphates (Morgan's)							
Nitrogen (%)	0.61	0.20	0.08	0.04			
Organic Carbon (%)	2.42	1.49	0.62	0.26			
C/N Ratio.	4	8	8	7			

Table 6 : Analytical data, Lutong Series (Profile 6)

Profile 7

Soil Group: Red-Yellow Podsollic
Family:
Series: LIKAU
Phase: 'Deep'
Location: Oya Rd. Agricultural Station, boundary peg 126.
Latitude: 2° 19' N
Longitude: 112° 3' E
Topography: Moderately rolling
Site: Upper slope
Slope: 12°

Parent material: Weathered Tertiary shale (Belaga III)
External drainage: Rapid
Vegetation/Land Use: Old secondary forest.
Altitude: c. 180 feet above sea level.
Rainfall: c. 126 inches.
Rainfall Class (Mohr): I
Lab. Nos: S2866 - S2873
Field Nos: S297 - S304
Date sampled: 12.4.64

0 - 1 inch Very dark greyish-brown (10YR 3/2) fine sandy clay loam. Moist. Structureless. Loose. Abundant rootlets. Few charcoal fragments. Porous. Distinct wavy boundary. (S2866)

1 - 3 inches Dark yellowish-brown (10YR 4/4) fine sandy clay loam. Moist. Structureless. Loose. Many roots and rootlets. Porous. Indistinct wavy boundary. (S2867)

3 - 8 " Yellowish-brown (10YR 5/8) fine sandy clay. Moist. Structureless. Friable. Few rootlets. Porous. Indistinct wavy boundary. (S2868)

8 - 20 " Yellowish-brown (10YR 5/8) fine sandy clay. Moist. Very weakly coarse subangular blocky structure. Friable. Rare rootlets. Porous. Distinct wavy boundary. (S2869)

20 - 34 " Yellowish-brown (10YR 5/8) fine sandy clay, with many faint medium brownish-yellow mottles. Moist. Weakly coarse subangular blocky structure. Friable. Few rootlets. Porous. Distinct wavy boundary. (S2870)

34 - 48 " Yellowish-brown (10YR 5/8) fine sandy clay, with few faint fine brownish-yellow mottles. Moist. Weakly coarse subangular blocky structure. Firm. Few pink and white stains from weathered shale. Rare rootlets. Porous. Distinct wavy boundary. (S2871)

48 - 58" Strong brown (7.5YR 5/8) fine sandy clay, with many faint medium and coarse brownish-yellow mottles and many distinct fine reddish-yellow mottles. Moist. Coarse subangular blocky structure. Firm. Rare rootlets. Porous. Indistinct wavy boundary. (S2872)

58 - 72 " Strong brown (7.5YR 5/8) and brownish-yellow (10YR 6/8) fine sandy clay, with many distinct medium yellowish-red mottles and few distinct fine white mottles. Moist. Weakly coarse subangular blocky structure. Firm. Rare rootlets. Porous. (S2873).

Laboratory number	2866	2867	2868	2869	2870	2871	2872
Upper depth of horizon (ins.)	0	1	3	8	20	34	48
Lower depth of horizon (ins.)	1	3	8	20	34	48	58
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	3.4	4.6	3.8	4.6	4.8	5.0	5.0
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium							
Magnesium							
Potassium							
Sodium							
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)							
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	184	55	84	56	54	52	83
Potassium	1400	1000	1250	1300	1800	1400	2800
Calcium	150	150	140	110	230	90	120
Magnesium	311	132	857	467	623	599	749
Iron							
Aluminium							
Group III Elements	4.3	2.8	5.1	5.8	8.9	7.3	11.3
Sulphates (Morgan's)							
Nitrogen (%)	0.61	0.07	0.22				
Organic Carbon (%)	10.35	0.73	2.68				
C/N Ratio.	17	10	14				

Table 7 : Analytical data, Likau Series (Profile 7)

Profile 8.

Soil Group: Red-Yellow Podsollic
Family: *Depth of horizon (ins.)*
Series: LIKAU
Phase: 'Deep'
Location: Oya Rd. Agricultural Station, rentis 1, peg 0
Latitude: 2° 19' N
Longitude: 112° 3' E
Topography: Moderately rolling
Site: Upper slope to summit
Slope: 12°

Parent material: Weathered Tertiary shale (Belaga III) with sandstone.
External drainage: Rapid
Vegetation/Land Use: Recently cleared and burnt, not planted
Altitude: c. 140 feet above sea level.
Rainfall: c. 126 inches
Rainfall Class (Mohr): I
Lab. Nos: S28~~36~~ - S2843
Field Nos: S267 - S274
Date sampled: 11.4.64

0 - 2 inches Greyish brown (10YR 5/2) sandy clay loam. Wet. Structureless. Slightly sticky. Nonplastic. Abundant rootlets and many roots. Few small charcoal fragments. Porous. Distinct wavy boundary. (S2836)

2 - 7 " Yellowish brown (10YR 5/4) sandy clay loam, stained dark grey (10YR 4/1) down main root channels. Wet. Structureless. Slightly sticky. Nonplastic. Many roots and rootlets. Rare small charcoal fragments. Porous. Indistinct wavy boundary. (S2837)

7 - 16 " Yellowish brown (10YR 5/8) fine sandy clay loam to fine sandy clay, with few faint fine yellowish red mottles and dark grey staining down main root channels. Wet. Weakly medium to coarse subangular blocky structure. Slightly sticky. Nonplastic. Few roots. Diffuse wavy boundary. (S2838)

16 - 26 " Yellowish brown (10YR 5/8) sandy clay loam to sandy clay with brown staining down main root lines and cracks. Moist. Weakly coarse subangular blocky structure. Friable. Few roots and rootlets. Porous. Diffuse wavy boundary. (S2839).

26 - 35 " Yellowish brown (10YR 5/8) fine sandy clay loam to fine sandy clay, with few faint fine yellowish red mottles. Moist. Weakly coarse subangular blocky structure. Friable. Few roots. Porous. Diffuse wavy boundary. (S2840)

35 - 51 " Yellowish brown (10YR 5/8) fine sandy clay, with few faint fine yellowish red mottles. Moist. Weakly coarse subangular blocky structure. Firm. Rare rootlets. Few fine quartz gravel. Porous. Diffuse wavy boundary. (S2841)

51 - 69 " As above, mottles few to many. (S2842)

69 - 73 " Strong brown (7.5YR 5/8) fine sandy clay, with many distinct medium yellowish red and brownish yellow mottles. Moist. Weakly coarse subangular blocky structure. Firm. Many fine and medium quartz gravel. (S2843)

at 73 " A stoneline of quartz gravel and weathered black and red iron-enriched sandstone and sandy shale fragments.

Laboratory number	2836	2837	2838	2839	2840	2841	2842
Upper depth of horizon (ins.)	0	2	7	16	26	35	51
Lower depth of horizon (ins.)	2	7	16	26	35	51	69
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	4.1	3.8	4.5	4.5	4.6	4.7	4.6
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium	68	44	44	56	56	32	68
Magnesium	0	0	0	0	0	0	0
Potassium	63	45	27	21	21	20	21
Sodium	29	tr	tr	31	tr	tr	33
Total bases (Meq./100 gm)	12.79	10.22	4.65	5.02	3.81	3.50	3.97
C.E.C. (Meq./100 gm)							
% base saturation							
Conc. HCl Extractable (ppm)							
Phosphorus	164	115	92	87	83	76	78
Potassium	1550	1550	3200	1950	1600	2300	2450
Calcium	700	190	110	180	340	100	130
Magnesium	563	497	833	791	455	491	365
Iron							
Aluminium							
Group III Elements	6.8	9.1	9.8	11.0	14.0	12.0	11.5
Sulphates (Morgan's)							
Nitrogen (%)	0.32	0.18	0.05				
Organic Carbon (%)	4.21	2.07	0.46				
C/N Ratio.	13	15	9				

Table 8 : Analytical data, Likau Series (Profile 8)

46.
Profile 9.

Soil Group: Red-Yellow Podsollic Parent material: Weathered Tertiary sandstone, with subordinate shale (Belaga III)

Family: External drainage: Rapid to very rapid

Series: LIKAU VARIANT Vegetation/Land Use: Grasses and shrubs with scattered trees. Fallow after hill padi.

Phase: Altitude: c.60 feet above sea level.

Location: Oya Rd. Agricultural Station, rentis 12, peg 5 Rainfall: c. 126 inches

Latitude: 2° 19' N Rainfall Class (Mohr): I

Longitude: 112° 3' E Lab. Nos: S2930 - S2937

Topography: Moderately rolling Field Nos: S362 - S369

Site: Lower slope Date sampled: 13.4.64

Slope: 27°

0 - 2 inches Very dark greyish brown (10YR 3/2) sandy loam. Moist. Structureless. Friable. Many rootlets. Porous. Distinct irregular boundary. (S2930).

2 - 8 " Very pale brown (10YR 7/4) fine sandy to sandy loam, with many distinct coarse dark brown mottles and many distinct medium and fine reddish yellow mottles. Moist. Structureless. Friable. Few roots and rootlets. Porous. Indistinct wavy boundary. (S2931)

8 - 15 " Yellow (10YR 7/8) loam, with few faint coarse light grey mottles. Moist. Weak coarse subangular blocky structure. Firm. Few rootlets. Porous. Indistinct wavy boundary. (S2932)

15 - 26 " Yellow (10YR 8/8), loam, with few faint fine light grey and reddish brown mottles. Moist. Weak coarse subangular blocky structure. Firm. Few rootlets. Porous. Indistinct wavy boundary. (S2933)

26 - 40 " Yellow (10YR 7/8) fine sandy clay loam, with many distinct medium and coarse reddish yellow mottles and many faint coarse light grey mottles. Moist. Weak coarse subangular blocky structure. Firm. Slightly porous. Diffuse wavy boundary. (S2934)

40 - 52 " Yellow (10YR 7/8) fine sandy clay loam, with many distinct fine and medium light grey and reddish brown mottles. Few rusty root channels. Moist. Weak medium subangular blocky structure. Firm. Slightly porous. Diffuse wavy boundary. (S2935).

52 - 58 " Yellow (10YR 7/8) fine sandy clay loam, with many distinct medium light grey and reddish brown mottles. Moist. Structureless to weakly medium subangular blocky. Firm. Slightly porous. Diffuse wavy boundary. (S2936).

58 - 70 " Yellow (10YR 7/8) fine sandy clay loam, with many distinct coarse light grey mottles, few distinct coarse reddish brown mottles and many distinct medium and fine reddish yellow mottles. Moist. Structureless. Firm. Slightly porous. (S2937).

	2930	2931	2932	3933	3934	3935	3936
Laboratory number							
Upper depth of horizon (ins.)	0	2	8	15	26	40	52
Lower depth of horizon (ins.)	2	8	15	26	40	52	58
Horizon							
<u>PHYSICAL</u>							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
<u>CHEMICAL</u>							
pH (H ₂ O; 1:2.5)	3.9	3.8	4.0	4.2	4.2	4.3	4.1
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium							
Magnesium							
Potassium							
Sodium							
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)							
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	178	71	48	38	34	35	27
Potassium	1045	1200	1525	1250	1800	2020	1650
Calcium	210	170	170	120	180	170	150
Magnesium	275	419	407	317	329	383	395
Iron							
Aluminium							
Group III Elements	3.1	4.0	6.1	5.0	6.5	5.1	6.1
Sulphates (Morgan's)							
Nitrogen (%)	0.47	0.10	0.04				
Organic Carbon (%)	3.95	1.53	0.32				
C/N Ratio.	8	15	8				

Table 9 : Analytical data, Likau Variant (Profile 9).

Profile 10Soil Group:Parent material: Weathered Tertiary shale (?) (Belaga III).Family:External drainage: RapidSeries: SIONGVegetation/Land Use: 7 month old tapioca, after hill padiPhase:Location: Oya Rd. Agricultural Station, boundary peg 41.Altitude: c.65 feet above sea level.Latitude: 2° 19' NRainfall: c. 126 inchesLongitude: 112° 3' ERainfall Class (Mohr): ITopography: Gently undulatingLab. Nos: S2851 - S2857Site: SummitField Nos: S282 - S288Slope: 4°Date sampled: 11.4.64

- 0 - 2 inches Greyish brown (10YR 5/2) sandy loam. Moist. Structureless. Loose. Abundant roots and rootlets. Porous. Distinct smooth boundary. (S2851)
- 2 - 6 " Greyish brown (2.5Y 5/2) sandy loam, with many distinct medium grey mottles. Moist. Structureless. Friable. Rare rootless. Porous. Diffuse irregular boundary. (S2852)
- 6 - 20 " As above but mottles few and faint. Diffuse irregular boundary. (S2853)
- 20 - 39 " Light brownish grey (2.5Y 6/2) sandy loam, with many faint coarse light grey mottles and few distinct fine reddish yellow mottles. Moist. Structureless. Friable. No roots seen. Very rare fine quartz gravel. Porous. Diffuse wavy boundary. (S2854)
- 39 - 60 " Light brownish grey to pale yellow (2.5Y 6/2-7/4) sandy loam, with few distinct fine reddish yellow and purple mottles. Moist. Structureless. Friable. Very rare fine quartz gravel. Porous. Diffuse wavy boundary. (S2855)
- 60 - 68 " Light grey (2.5Y 7/2) sandy loam to sandy clay loam, with many distinct fine and medium reddish yellow mottles and few distinct fine purple mottles. Moist. Structureless. Friable. Rare small fragments of weathered iron-enriched sandy shale. Porous. Diffuse wavy boundary. (S2856).
- 68 - 72 " Light grey (2.5Y 7/2) sandy loam to sandy clay loam, with many distinct fine reddish yellow mottles and few distinct fine purple mottles. Many fine rusty root channels. Moist. Structureless. Friable. Porous. (S2857).

Laboratory number	2851	2852	2853	2854	2855	2856	2857
Upper depth of horizon (ins.)	0	2	6	20	39	60	68
Lower depth of horizon (ins.)	2	6	20	39	60	68	72
Horizon.							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	6.1	4.6	4.7	4.8	4.8	4.8	4.5
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium							
Magnesium							
Potassium							
Sodium							
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)							
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	180	53	55	34	40	38	21
Potassium	1200	1000	1400	1450	2000	2510	2450
Calcium	2280	170	60	200	50	170	310
Magnesium	569	144	300	40	389	457	276
Iron							
Aluminium							
Group III Elements	3.0	1.9	2.7	4.3	4.3	4.4	4.3
Sulphates (Morgan's)							
Nitrogen (%)	0.22	0.08	0.04				
Organic Carbon (%)	11.52	0.75	0.44				
C/N Ratio.	52	9	11				

Table 10: Analytical data, Siang Series (Profile 10).

Profile 11.

<u>Soil Group:</u>	<u>Parent material:</u> Weathered Tertiary shale (?) (Belaga III).
<u>Family:</u>	<u>External drainage:</u> Rapid
<u>Series:</u> SIONG	<u>Vegetation/Land Use:</u> 7 month old tapioca after hill padi
<u>Base:</u>	<u>Altitude:</u> c. 65 feet above sea level.
<u>Location:</u> Oya Rd. Agricultural Station, rentis 1, peg 10.	<u>Rainfall:</u> c. 126 inches
<u>Latitude:</u> 2° 19' N	<u>Rainfall Glass (Mohr):</u> I
<u>Longitude:</u> 112° 3' E	<u>Lab. Nos:</u> S2858 - S2865
<u>Topography:</u> Gently undulating	<u>Field Nos:</u> S289 - S296
<u>Site:</u> Summit	<u>Date sampled:</u> 11.4.64
<u>Slope:</u> <1°	
0 - 2 inches	Greyish brown (10YR 5/2) sandy loam, with many faint medium dark grey mottles. Moist. Structureless. Friable. Abundant roots and rootlets. Porous. Distinct irregular boundary. (S2858)
2 - 5 "	Greyish brown (2.5Y 5/2 and 10YR 5/2) sandy loam, with few distinct fine light grey and pale yellow mottles. Moist. Structureless. Friable. Few roots and rootlets. Porous. Diffuse irregular boundary. (S2859).
5 - 13 or 18	Light brownish grey (2.5Y 6/2) sandy loam, with many faint coarse light grey mottles and frequent faint fine reddish yellow mottles. Moist. Structureless. Very friable. Few roots. Porous. Distinct irregular boundary. (S2860)
13 or 18 - 28	Light brownish grey to light grey (2.5Y 6/2 - 7/2) sandy loam to sandy clay loam, with many faint coarse light grey mottles. Many fine rusty root channels. Moist. Structureless. Friable. Few roots and rootlets. Porous. Diffuse irregular boundary. (S2861)
28 - 40 "	Light grey (2.5Y 7/2) sandy loam to sandy clay loam, with few distinct fine reddish brown mottles. Many rusty root channels. Moist. Structureless. Friable. No roots seen. Porous. Indistinct wavy boundary.
40 - 52 "	Coarse angular quartz gravel in a matrix of very pale brown (10YR 7/4) sandy clay loam, with many distinct medium reddish brown mottles. Few rusty root channels. Moist. Structureless. Friable. Rare small quartz stones. Porous. Indistinct wavy boundary. (S2863).
52 - 57 "	Light grey (2.5Y 7/2) sandy clay loam. Many rusty root channels. Moist. Structureless. Friable. Frequent to abundant coarse quartz gravel. Porous. This horizon forms an intermittent inlier in the material of the horizon above. (S2864)
57 - 65 "	As 40 - 52 inches, but matrix colour light grey (2.5Y 7/2). (S2865).

	2858	2859	2860	2861	2862	2863	2864
Laboratory number							
Upper depth of horizon (ins.)	0	2	5	13	28	40	52
Lower depth of horizon (ins.)	2	5	13	28	40	52	57
Horizon							
PHYSICAL							
Coarse earth (%)							
Fine earth							
Very coarse sand (%)							
Coarse sand (%)							
Medium sand (%)							
Fine sand (%)							
Very fine sand (%)							
Sand (%)							
Silt (%)							
Clay (%)							
CHEMICAL							
pH (H ₂ O; 1:2.5)	4.4	4.0	4.0	4.2	4.2	4.3	4.1
CaCO ₃ (%)							
Exchangeable (Meq./100 gm)							
Calcium	383	68	80	56	44	44	44
Magnesium	44	0	0	0	0	0	0
Potassium	70	45	26	21	19	16	18
Sodium	34	33	32	tr	tr	tr	43
Total bases (Meq./100 gm)							
C.E.C. (Meq./100 gm)	4.70	3.34	2.08	1.66	1.76	1.55	2.03
% base saturation							
Phosphorus (available)							
P-retention (%)							
Conc. HCl Extractable (ppm)							
Phosphorus	110	35	21	28	21	45	35
Potassium	1300	1150	1240	1540	1240	1400	2830
Calcium	470	80	320	210	160	220	160
Magnesium	84	138	1006	216	341	174	406
Iron							
Aluminium							
Group III Elements	1.1	1.2	2.0	3.1	2.5	3.4	5.2
Sulphates (Morgan's)							
Nitrogen (%)	0.14	0.08	0.04				
Organic Carbon (%)	1.39	0.73	0.29				
C/N Ratio.	10	9	7				

Table 11: Analytical data, Siang Series (Profile 11)

Profile 12.

Soil Group: Alluvial/Groundwater laterite intergrade (provisional)
Family:
Series: MALANG
Phase:
Location: Oya Rd. Agricultural Station, rentis 10, peg 4
Latitude: 2° 19' N
Longitude: 112° 3' E
Topography: Alluvial flat
Site: Bottomland.
Slope: < 1°

Parent material: Recent alluvium
External drainage: Slow
Vegetation/Land Use: Tall grasses and scattered Exmperan; fallow after wet padi
Altitude: c. 50 feet above sea level
Rainfall: c. 126 inches
Rainfall Class (Mohr): I
Lab. Nos: S2921 - S2925
Field Nos: S353 - S357
Date sampled: 12.4.64.

0 - 3 inches Yellowish brown (10YR 5/4) clay. Moist. Weak medium subangular blocky structure. Firm. Many rootlets. Porous. Distinct wavy boundary. (S2921)

3 - 9 " Brownish yellow (10YR 6/6) clay. Moist. Weak medium subangular blocky structure. Firm. Rare rootlets. Porous. Indistinct irregular boundary. (S2922).

9 - 17 " Yellowish brown (10YR 5/8) clay. Moist. Weak medium subangular blocky structure. Firm. Very rare rootlets. Porous. Distinct irregular boundary. (S2923).

17 - 29 " Very pale brown (10YR 7/4) clay, with abundant faint fine reddish brown mottles. Moist. Structureless to weak medium subangular blocky. Firm. Very rare rootlets. Slightly porous. Diffuse irregular boundary. (S2924).

29 - 47 " Light grey (10YR 7/1) clay, with many distinct fine reddish yellow mottles and rusty root channels. Moist. Structureless to weak medium subangular blocky. Firm. Very rare rootlets. Slightly porous. (S2925).

	2921	2922	2923	2924	2925
Laboratory number	0	3	9	17	29
Upper depth of horizon (ins.)	3	9	17	29	47
Lower depth of horizon (ins.)					
Horizon.					
PHYSICAL					
Coarse earth (%)					
Fine earth					
Very coarse sand (%)					
Coarse sand (%)					
Medium sand (%)					
Fine sand (%)					
Very fine sand (%)					
Sand (%)					
Silt (%)					
Clay (%)					
CHEMICAL					
pH (H ₂ O; 1:2.5)	4.0	3.8	3.9	4.0	4.1
CaCO ₃ (%)					
Exchangeable (Meq./100 gm)					
Calcium					
Magnesium					
Potassium					
Sodium					
Total bases (Meq./100 gm)					
C.E.C. (Meq./100 gm)					
% base saturation					
Phosphorus (available)					
P-retention (%)					
Conc. HCl Extractable (ppm)					
Phosphorus	254	154	186	158	94
Potassium	3000	5420	4550	3660	2745
Calcium	210	210	240	240	220
Magnesium	1054	1989	1264	1288	928
Iron					
Aluminium	6.3	13.3	7.6	6.9	6.6
Group III Elements					
Sulphates (Morgan's)					
Nitrogen (%)	0.28	0.12			
Organic Carbon (%)	1.83	0.66			
C/N Ratio.	7	6			

Table 12: Analytical data, Malang Series (Profile 12)

56.
Profile 13.

Soil Group: Alluvial/Groundwater
Laterite intergrade (provisional)

Parent material: Recent alluvium

Family:

External drainage: Slow

Series: MALANG

Vegetation/Land Use: Tall grasses and
scattered Emperan; fallow after wet padi

Phase:

Altitude: c. 50 feet above sea level

Location: Oya Rd. Agricultural
Station, rentis 8, peg 3

Rainfall: c. 126 inches

Latitude: 2° 19' N

Rainfall Class (Mohr): I

Longitude: 112° 3' E

Lab. Nos: S2926 - S2929

Topography: Alluvial flat

Field Nos: S358 - S361

Site: Bottomland

Date sampled: 12.4.64

Slope: <1°

- 0 - 2 inches Dark brown to brown (10YR 4/3) clay. Moist. Structureless to weak medium subangular blocky. Slightly firm. Many roots and rootlets. Distinct irregular boundary. (S2926)
- 2 - 16 " Yellowish brown (10YR 5/8) clay, with few faint fine light grey mottles. Moist. Medium subangular blocky structure. Firm. Few rootlets. Porous. Indistinct irregular boundary. (S2927)
- 16 - 37 " Yellowish brown (10YR 5/6) clay, with abundant distinct medium and coarse grey and light grey mottles. Moist. Weak medium to fine subangular blocky structure. Firm. Very rare rootlets. Slightly porous. Indistinct irregular boundary. (S2928).
- 37 - 59 " Pale yellow (2.5Y 7/4), yellowish red (5YR 5/6) and white (2.5Y 8/0) clay. Moist. Weak medium subangular blocky structure. Firm. Very rare rootlets. Slightly porous. (S2929).

	2926	2927	2928	2929
Laboratory number	0	2	16	37
Upper depth in horizon (ins.)	2	16	37	57
Lower depth in horizon (ins.)				
Horizon				
PHYSICAL				
Coarse earth (%)				
Fine earth				
Very coarse sand (%)				
Coarse sand (%)				
Medium sand (%)				
Fine sand (%)				
Very fine sand (%)				
Sand (%)				
Silt (%)				
Clay (%)				
CHEMICAL				
pH (H ₂ O; 1:2.5)	4.4	4.5	4.6	5.0
CaCO ₃ (%)				
Exchangeable (Meq./100 gm)				
Calcium	200	59	73	67
Magnesium	94	11	7	59
Potassium	64	38	41	41
Sodium	85	78	66	64
Total bases (Meq./100 gm)	18.56	10.37	9.74	8.80
C.E.C. (Meq./100 gm)				
% base saturation				
Phosphorus (available)				
P-retention (%)				
Conc. HCl Extractable (ppm)				
Phosphorus	460	162	164	191
Potassium	4950	4250	3150	5750
Calcium	270	160	170	160
Magnesium	1581	1288	851	1503
Iron				
Aluminium	10.7	9.4	7.0	12.0
Group III Elements				
Sulphates (Morgan's)				
Nitrogen (%)	0.53	0.10		
Organic Carbon (%)	4.59	0.40		
C/N Ratio.	9	4		

Table 13: Analytical data, Malang Series (Profile 13).

58.

Profile 14.

Soil Group: Alluvial

Family:

Series: SEMILAJAU

Phase:

Location: Oya Rd. Agricultural
Station, near boundary peg 44

Latitude: 2° 19' N

Longitude: 112° 3' E

Topography: Levee

Site: Very low summit

Slope: < 1°

Parent material: Recent riverine alluvium

External drainage: Moderately rapid

Vegetation/Land Use: Secondary forest with
scattered fruit trees.

Altitude: c. 50 feet above sea level

Rainfall: c. 126 inches

Rainfall Class (Mohr): I

Lab. Nos: S2896 - S2902

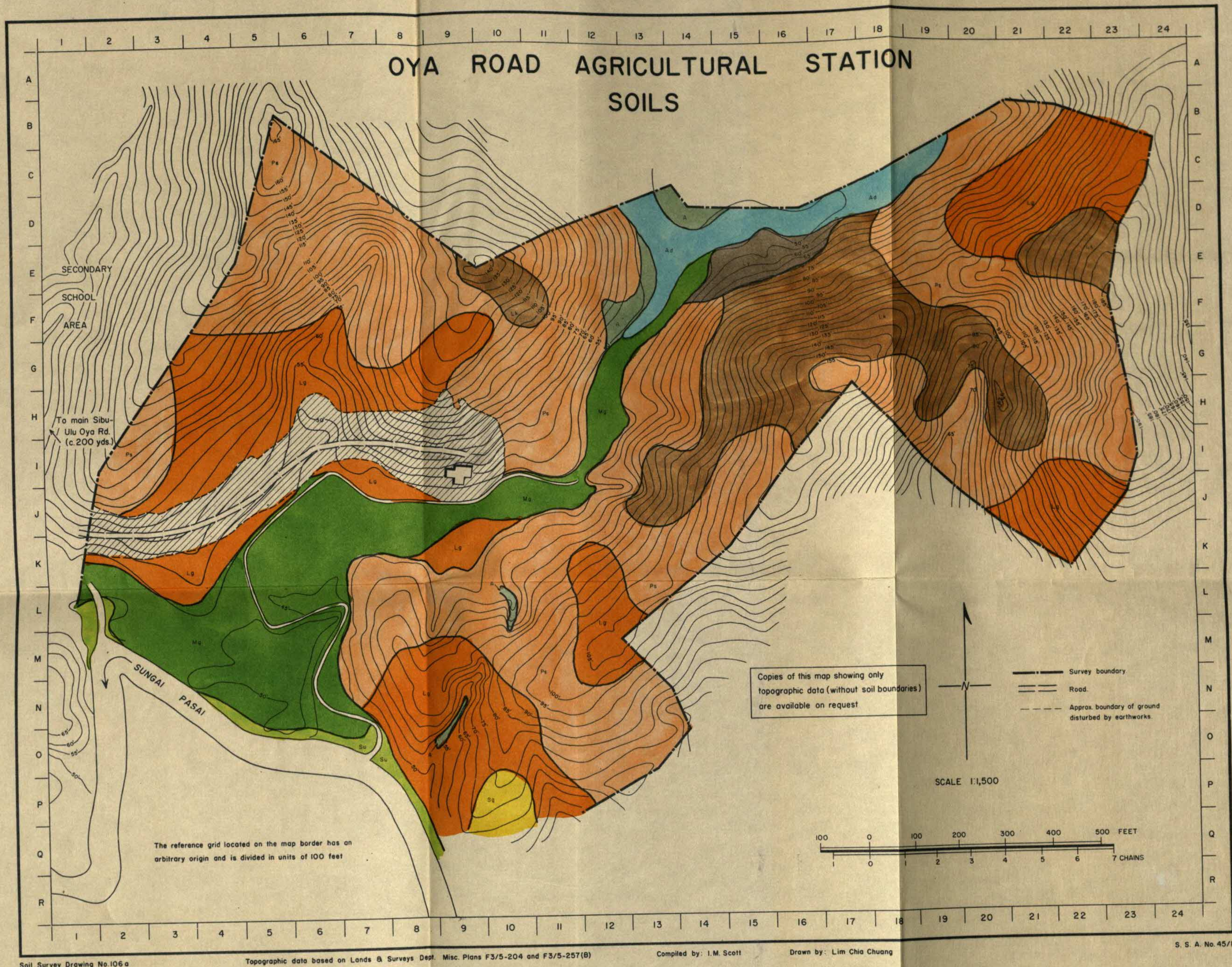
Field Nos: S328 - S334

Date sampled: 12.4.64

- 0 - 3 inches Strong brown (7.5YR 5/6) fine sandy loam. Moist. Structureless.
Very friable. Many rootlets. Porous. Indistinct irregular
boundary. (S2896).
- 3 - 13 " Yellowish brown (10YR 5/6) loamy sand. Moist. Structureless.
Very friable. Few rootlets. Porous. (S2897)
- 13 - 23 " As above, with few rootlets. (S2898)
- 23 - 34 " As above. (S2899)
- 34 - 45 " As above. Diffuse irregular boundary. (S2900).
- 45 - 57 " Yellowish brown (10YR 5/8) fine sandy loam, with few faint
fine light grey mottles. Wet. Structureless. Nonsticky.
Nonplastic. Few rootlets. Diffuse irregular boundary.
(S2901)
- 57 - 71 " Dark yellowish brown (10YR 4/4) fine sandy loam with few
faint fine light grey mottles. Wet. Structureless.
Nonsticky. Nonplastic. Few rootlets. Porous. (S2902).

REFERENCES

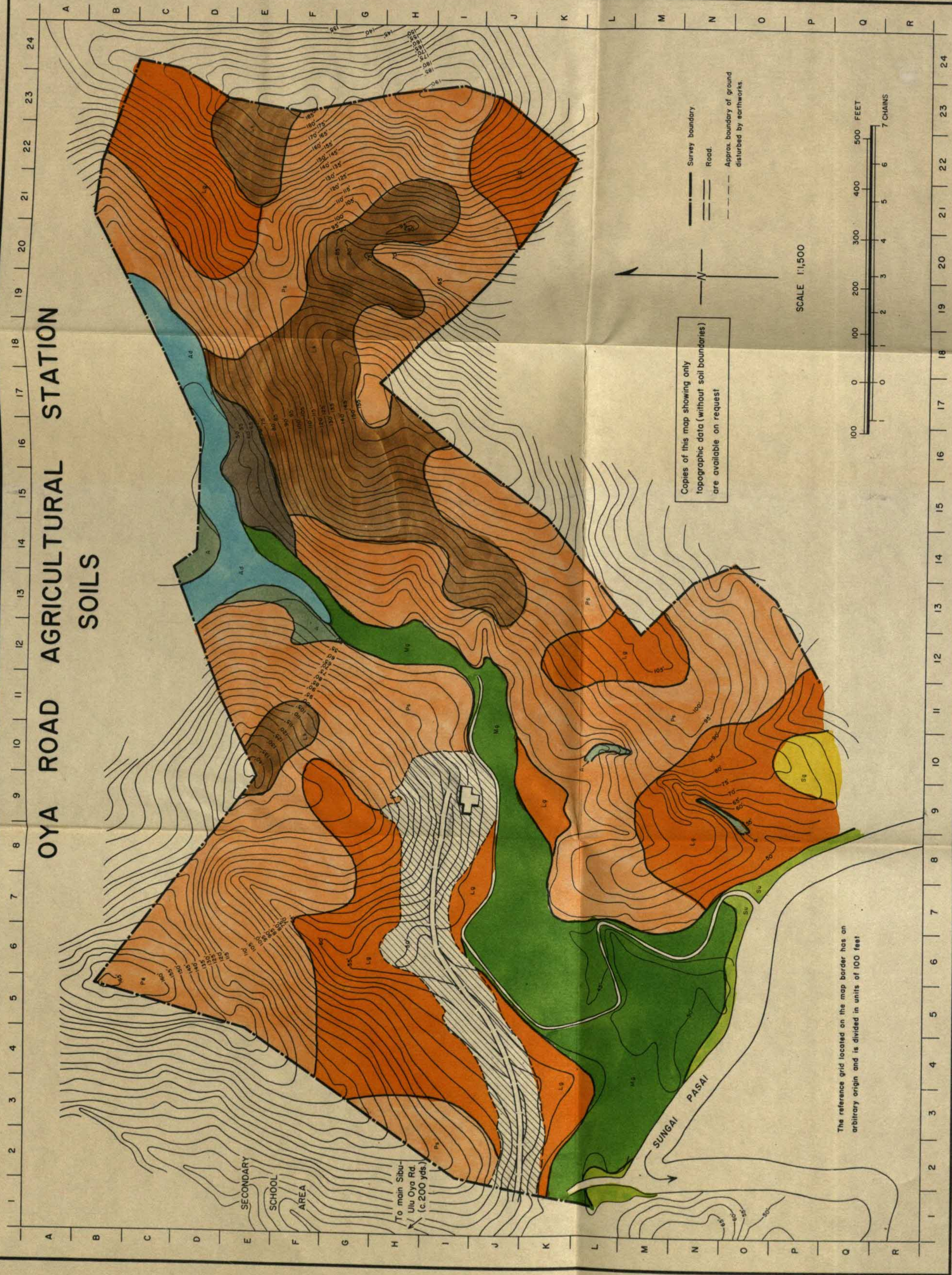
1. ANON. 1961 Rainfall Statistics of the British Borneo Territories. Department of Civil Aviation and Meteorological Services, British Borneo Territories.
2. MOHR, E.C.J. 1944. The Soils of Equatorial Regions (translated by R.L. Pendleton). Ann Arbor
3. WOLFENDEN, E.B. 1960 The geology and mineral resources of the lower Rajang valley and adjoining areas. British Borneo Geol. Survey Mem. 11
4. GRANT, C.J. 1960 Report on the Reconnaissance soil survey of the Sibul/Oya road, 3rd Division. Dept. of Agric., Soil Survey Report 28.
5. ANDRIESSE, J.P. 1962 Report on the reconnaissance soil survey of the Pasai-Siong-Sekau area, 3rd Division. Dept. of Agric. Soil Survey Report 45.
6. WALL, J.R.D. 1964 Final report on a semi-detailed soil survey of Luak Experiment Station, 4th Division. Dept. of Agric., Soil Survey Report 35/2.
7. ANDRIESSE, J.P. 1964 Soil and Land Potential in the Serian Development Area. Dept. of Agric., Soil Survey Report 44/1.



KEY

ORIGIN	GREAT SOIL GROUP	SERIES	DRAINAGE CLASS	SERIES CODE NUMBER	MAPPING SYMBOL	REMARKS	ACREAGE
RESIDUAL	RED-YELLOW PODSOLIC	PASAI	IMPERFECT	—	Pa	Moderately deep to deep soils from shales and sandstones of the Belaga III formation (Tertiary).	14.6
		LUTONG		—	Lg		7.0
		LIKAU	GOOD	—	Lk		4.0
COLLUVIAL		LIKAU VARIANT	IMPERFECT	—	Lv		0.3
RESIDUAL ?	PODSOLIC	SIONG		—	Sq		0.2
ALLUVIAL	ALLUVIAL/GROUND- WATER PODSOL	MALANG	MODERATELY GOOD TO IMPERFECT	4305	Mg	Important alluvial soil throughout the country.	3.8
		SEMILAJAU	GOOD TO EXCESSIVE	4311	Su		0.3
	ALLUVIAL	Minor Alluvial Soils	POOR	—	A	Very variable. Undifferentiated	0.3
ORGANIC	BOG	ANDERSON	VERY POOR	5001	Ad	Depth very variable	0.9
Ground disturbed in building the access road into the area						Downslope wade effects extend beyond the boundary shown.	1.9

OYA ROAD AGRICULTURAL STATION SOILS



Soil Survey Drawing No. 106a

Topographic data based on Lands & Surveys Dept. Misc. Plans F3/5-204 and F3/5-257(B)

Compiled by: I.M. Scott

Drawn by: Lim Chia Chuang

S. S. A. No. 45/1

KEY

ORIGIN	GREAT SOIL GROUP	SERIES	DRAINAGE CLASS	SERIES CODE NUMBER	MAPPING SYMBOL	REMARKS	ACREAGE
RESIDUAL	RED-YELLOW PODSOLIC	PASAI	IMPERFECT	-		Moderately deep to deep soils from shales and sandstones of the Belaga III formation (Tertiary).	14.6
		LUTONG		-			7.0
COLLUVIAL	PODSOLIC	LIKAU	GOOD	-		Important alluvial soil throughout the country.	4.0
		LIKAU VARIANT		-			0.3
RESIDUAL ?	PODSOLIC	SIONG	IMPERFECT	-		Very variable. Undifferentiated	0.2
		MALANG		4305			3.8
ALLUVIAL	ALLUVIAL/GROUND-WATER PODSOL	SEMILAJAU	GOOD TO EXCESSIVE	4311		Depth very variable	0.3
		Minor Alluvial Soils		-			0.3
ORGANIC	BOG	ANDERSON	VERY POOR	5001		Downslope waste effects extend beyond the boundary shown.	0.9
							1.9

Ground disturbed in building the access road into the area

