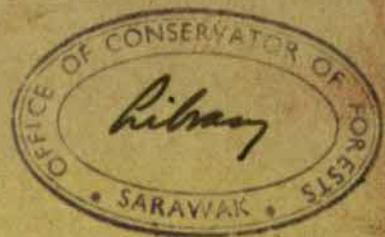


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Report No. 28/2



Report on a Semi - Detailed Soil Survey
of the
FOREST EXPERIMENTAL NURSERY
OYA ROAD
3 rd Division

by
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REPORT ON A SEMI-DETAILED SOIL SURVEY OF
THE FOREST EXPERIMENTAL NURSERY,
OYA ROAD, THIRD DIVISION.

INTRODUCTION

An experimental nursery was established in 1964 by the Forest Department on the Sibiu-Oya Road. The nursery area is calculated at 495 acres. It lies entirely to the north of the road and fronts onto it between roughly mile 11½ and mile 13, except for a portion occupied by the Police Firing Range.

It was Forest Department's intention to establish five experimental plots in the first phase of developing the area and in order to locate suitable sites a soil survey was requested. The requirements of the survey were to establish the range of soils present in the area and locate five sites within which the soil was sufficiently uniform for experimental data to be valuable and sufficiently representative for such data to have useful application over a wide area.

The survey was therefore undertaken at a semi-detailed level, the field party, which consisted of the Surveyor and two assistants, working in the area during the last week of May, 1965. The survey was completed in a short time as a rentis grid, shown on Map 2, had been cut by Forest Department staff prior to the arrival of the party.

Six possible experimental sites were located and the Forest Department was advised of them. The present report describes the range of soils in the area and includes a soil map which should assist in planning further development.

GEOLOGY

The area lies close to the southern boundary of the Belaga III geological Formation. Stage III of this Formation is considered to be of Middle to Upper Eocene age and outcrops over some 1,200 square miles of country in a broad east-west band. The lithology has been described by Wolfenden (1).

Arenaceous rocks are more important in this Stage of the Belaga Formation than in other Stages although argillaceous rocks are still dominant. Where sandstone bands are thick they are generally medium or coarse grained and commonly give rise to high ridges following the strike, which in this locality is roughly orientated eastsoutheast-westnorthwest. In the south of the survey area the higher hills are dominantly formed of sandstones.

Argillaceous rocks, which are for convenience all styled shales in this report, are described by Wolfenden (1) as argillites, slates and occasional phyllites. Thin bands of sandstones and shales are commonly interbedded. Where this is the case the sandstones are generally fine-grained. The northern half of the survey area is underlain largely, if not entirely, by shales and a shale/sandstone complex occurs in places close to the road.

TOPOGRAPHY.

There is a considerable contrast between the topography of the northern half of the survey area and that of the southern half, linked with the contrast in lithology. Close to the road and for some distance to the north of it the area is dominated by a series of steeply sloping hills rising to summits at 130-180 feet above sea-level and commonly over 100 feet above adjacent valley bottoms. These are largely composed of sandstone. Lower spurs between minor streams are generally below 100 feet and where investigated these lower hills appear to be composed of mixed shales and sandstones. The distribution of the higher hills suggests that at one time they formed part of three parallel strike ridges. Subsequent erosion has now degraded these ridges to numerous isolated hill masses.

At a line roughly bisecting the survey area (and orientated with the strike) this strongly rolling terrain gives way abruptly to very gently undulating country in the north of the area, in which hill summits rarely exceed 60 feet above sea-level and the amplitude of relief is roughly 30-40 feet. All points examined in this subdued relief were underlain by shales. Sandstones were not encountered.

There is thus a strong correlation between strongly rolling uplands and sandstones and between undulating lowlands and shales. The contour data for the area and land peripheral to it also shows a rough accordance of summits which suggests that the contrasts in terrain may be partly a reflection of two erosion levels at about 200 feet and 80 feet above sea-level respectively.

DRAINAGE

The headwaters of one small stream drain the southern portion of the area to the west. The lower course of this stream was not investigated. It may drain directly into the Batang Rajang swamplands. The central and northern parts of the area are drained by three small valleys which, on the northern boundary of the area, merge to form a tributary of the Sungai Pasai Bun. The latter has few major tributaries but flows north for a considerable distance before entering the Batang Igan.

Valleys in the hilly south of the area are narrow and steep-sided. The Pasai tributaries, however, flow through more moderate terrain and while the streams themselves are narrow they are surrounded by belts of swampy bottomland of moderate width. On the northern boundary the Pasai waters flow through a paya in which no stream course was discernible at the time of survey.

SOILS

Soils of ten families were recognised in the area, three of which are of insufficient extent to allow separation on the soil map, (Bekenu, Malang and Bijat). The soils have been mapped at the Family level in seven units. With the exception of the Saratok-Semadoh Association, in which the soil pattern was too complex to allow separation of these two families, each mapping unit is a simple association in which the family after which the unit is named is dominant. In the following sections a general description of each family is first given, and its importance elsewhere in the country is briefly noted. Each mapping unit is then described, the soil descriptions given under each association referring specifically to the survey area.

SOIL FAMILIES

RED-YELLOW PODSOLIC SOILS.

Within the Great Soil Group of Red-Yellow Podsollic Soils are placed the Nyalau, Bekenu, Merit and Malang Families.

Nyalau Family

Nyalau soils are medium to coarse textured (sandy clay loam or coarser) in the subsoil and, while having a textural B horizon, may have a rather uniform colour in the surface 48 inches, being generally yellow to reddish yellow. They are friable throughout and, although imperfectly-drained profiles occur, are usually well-drained. They are derived from sandstones or from mixed sandstones and shales. Nyalau soils are present in all Divisions but are most extensive in Third and Fourth Divisions. In Fourth Division they are commonly coarse-textured and on steep slopes have a considerable erosion hazard. Where seen in Third Division they are generally not coarser than sandy loam and while still susceptible to erosion, the hazard is somewhat less. Inherent fertility is low.

Bekenu Family

The Bekenu Family is a recent addition to the Sarawak classification, introduced to cater for soils transitional in character between those of the Nyalau and the Merit Families, the purpose being to limit the textural ranges of these two important families and give greater contrast between them.

Soils which have loamy or sandy A2 horizons but clayey or clay loamy B horizons are placed in the Bekenu Family. Bekenu soils are found in all Divisions but an assessment of their relative importance requires reappraisal of Merit and Nyalau mapping units, which has not yet been made. Some series within the family have a moderate erosion hazard on steep slopes. Natural fertility is low.

Merit Family

Merit soils are firm, well-drained to imperfectly-drained, yellow to yellowish red clays derived from shales, possibly with minor admixtures of sandstone. Texture may be clay loam in the A2 horizon. In many profiles subsoil texture is rather uniform, the B horizon being characterised more by higher chromas. Weathered shale is commonly encountered within 48 inches of the surface and a stoneline of iron-enriched shale fragments may be present at the base of the B horizon. This is also a feature of some Nyalau soils. Merit soils are relatively stable although conservation measures are required on steep slopes. Inherent fertility is low to moderate.

The majority of soils mapped as Merit in this area are only provisionally classed as such. Their characteristics suggest that they would more appropriately be considered Groundwater Laterites rather than Red-Yellow Podsollic Soils. The point is discussed below under the Merit Association.

Malang Family

Malang soils, of minor importance in this area although widespread in Sarawak as a whole, are well-drained to imperfectly-drained strong brown to yellow alluvial clays. They are grouped with the Red-Yellow Podsollic Soils, although they are probably more accurately considered as intergrades to Groundwater Laterites.

GREY-WHITE PODSOLIC SOILS

One family, Saratok, is classified in the Great Soil Group of Grey-White Podsollic Soils.

Saratok Family

Saratok soils are developed from sandstones, mixed sandstones and shales or, more rarely, shales with quartz stringers and veins. The family includes both residual and colluvial series. The profile is generally pale yellow to light grey in colour and while a textural B horizon is commonly present, this horizon is not heavier-textured than clay loam. In series of colluvial origin the profile commonly consists of poorly sorted material and stony bands may occur.

Saratok soils are common in all Divisions and are generally found on low hills and on footslope sites. Their inherent fertility is very low.

LOW-HUMIC GLEY SOILS

Three families within the Great Soil Group of Low-Humic Gley Soils occur in the area, Semadoh Family on undulating uplands, Bijat and Plan Families on bottomland sites.

Semadoh Family

Semadoh soils are clayey or heavy loamy soils derived from shales and found on upland sites. Due to their fine texture their internal drainage is very poor and despite moderately rapid external drainage they are gleyed to within 24 inches of the surface and commonly throughout the profile.

Soils of the Semadoh Family are of minor importance in First Division but common elsewhere although their importance in the survey area is possibly atypical. Where noted in other areas these soils generally cover restricted areas. They are unsatisfactory agricultural soils due to low natural fertility and poor moisture relationships.

Bijat Family

Soils of the Bijat Family are poorly-drained or very poorly-drained clays or heavy loams, derived from recent riverine alluvium and found on present bottomlands. Mucky or peaty topsoils may be present but organic surface horizons are by definition not greater than 6 inches in thickness.

Bijat soils are found throughout the country and, due to their recent origin, may be moderately fertile. Without drainage measures they are, however, of only limited suitability for dry land crops.

Plan Family

Plan Family soils are associated with Bijat soils on present bottomlands. They have sandy or light loamy textures in the subsoil, their range of characteristics being otherwise similar to that of soils in the Bijat Family. Like the latter, Plan soils are found throughout the country but are generally only of importance in smaller stream valleys draining from areas of coarse-textured upland soils. They have lower agricultural potential than Bijat soils.

HALF-BOG SOILS

Mukah Family is classified in the Great Soil Group of Half-Bog Soils.

Mukah Family

Mukah Family consists of soils in which between 6 inches and 3 feet of peat or muck overlie alluvial clays. Water-tables are always close to the surface and the underlying mineral horizons strongly gleyed. Mukah soils are widely represented in all Divisions, generally (as in this area) in association with Bog Soils.

BOG SOILS

Anderson Family is classified in the Great Soil Group of Bog Soils.

Anderson Family

The Anderson Family comprises organic soils greater than 3 feet in thickness. No series subdivision has been made and these soils are at present normally mapped solely in depth phases, limits of 6 and 10 feet being considered significant. These peats commonly greatly exceed 10 feet in thickness and are dominant in many coastal and interior riverine areas in all Divisions. Except where shallow they are of very limited use for agriculture.

MAPPING UNITS

In the following sections the soil associations delimited on Map 2 are described. Unless otherwise stated the soil characteristics given refer to the soil families as found in the survey area and are not necessarily typical of those families in other parts of the country.

Nyalau Association

The Nyalau Association mantles the main hills in the southern half of the area. Nyalau Family soils are dominant but are locally replaced by soils in the Bekenu Family.

Nyalau soils are, at most sites, yellowish brown loams or fine sandy clay loams grading to fine sandy clay loams at depth. Below 24 inches the profile may be strong brown in colour but at most sites little strengthening of chroma was recorded with depth. The profile is characteristically porous and friable throughout. On all hills Nyalau soils are deep and weathered rock was not encountered within 48 inches. In one pit (Profile 2 in the Appendix) red and light yellowish brown mottles were seen between 48 and 72 inches depth, probably indicating vestiges of weathered sandstone in the profile. In the west of the area, where a site close to the road is at present being developed and many Nyalau profiles are exposed in terraces and building excavations, a prominent stoneline of iron-enriched weathered sandstone and shale fragments was seen, its upper boundary being at irregular depths but generally between 24 and 36 inches. This feature was also noted in some road cutting exposures but not in augerings. It is either restricted to Nyalau soils in the west and south of the area or occurs elsewhere at depths greater than 48 inches.

Normally Nyalau soils are well-drained and free from mottles in the surface four feet. On some footslope sites, however, particularly when Nyalau soils grade into soils of the Plan Family, imperfectly-drained profiles were noted. Such profiles are generally yellow in colour with coarse light grey mottles throughout the subsoil. Where present at all these soils form a belt of very narrow width.

Many Nyalau profiles recorded in this area are closely comparable with profiles of Likau Series, recorded ten miles to the east (Scott, 2).

Bekenu soils were noted on the flanks of the hill which rises to over 200 feet in the centre of the area, on the hill close to the junction of the main road with the minor track which bounds the area in the east and also on the most westerly of the hills included in the area (not fully covered by contour data). Similar minor patches of these soils probably occur elsewhere in the association.

Bekenu soils as found in this area are equivalent in all respects except texture to adjacent Nyalau soils. They are generally fine sandy clay loams in the A2 horizon, grading to fine sandy clays in the B horizon. They are, however, friable and porous throughout. Their presence possibly reflects bands of shale interbedded with the sandstones or alternatively felspathic sandstones which weather to soils with a higher clay content than elsewhere.

Soils in this association are appropriate for experimental purposes as they are representative of large areas of Sarawak. Stonelines where present are unlikely to be a barrier to main roots although, as this is the most obviously variable feature of Nyalau profiles in the survey area, it is possibly best to avoid siting plots on Nyalau soils where this occurs at shallow depths. Nyalau soils are otherwise likely to be a sufficiently uniform medium for forestry purposes for plot data to be comparable. Two sites on Nyalau soils are therefore suggested. Site A is located close to the western boundary of the area and very near to the minor road which runs through that part of the nursery. Profile 1 in the Appendix (Field Numbers S720/728 on end maps) refers. Site B is further south, immediately beyond the area at present being developed. Profile 2 in the Appendix (Field Numbers S713/719 on end maps) refers. Both sites are on moderately steep hill flanks of 20-25° slope and will require conservation measures to avoid gully erosion on clearance.

A third possible site - Site C - is suggested in the east of the area, within the Nyalau Association but sited on Bekenu soils. Slopes are comparable with Sites A and B. Conservation measures will be necessary on clearance. Profile 3 in the Appendix (Field Numbers S746/751 on end maps) refers. It will be interesting to see if the somewhat heavier subsoil textures of these soils are in any way of significance to silviculture.

Suggested Sites A, B and C are roughly located in relation to the soil pattern by the sites of their respective profile pits on Map 2. Suggested rough boundaries of these and sites D, E and F in relation to the available contour data are given on enlarged portions of the base map in Fig. 1.

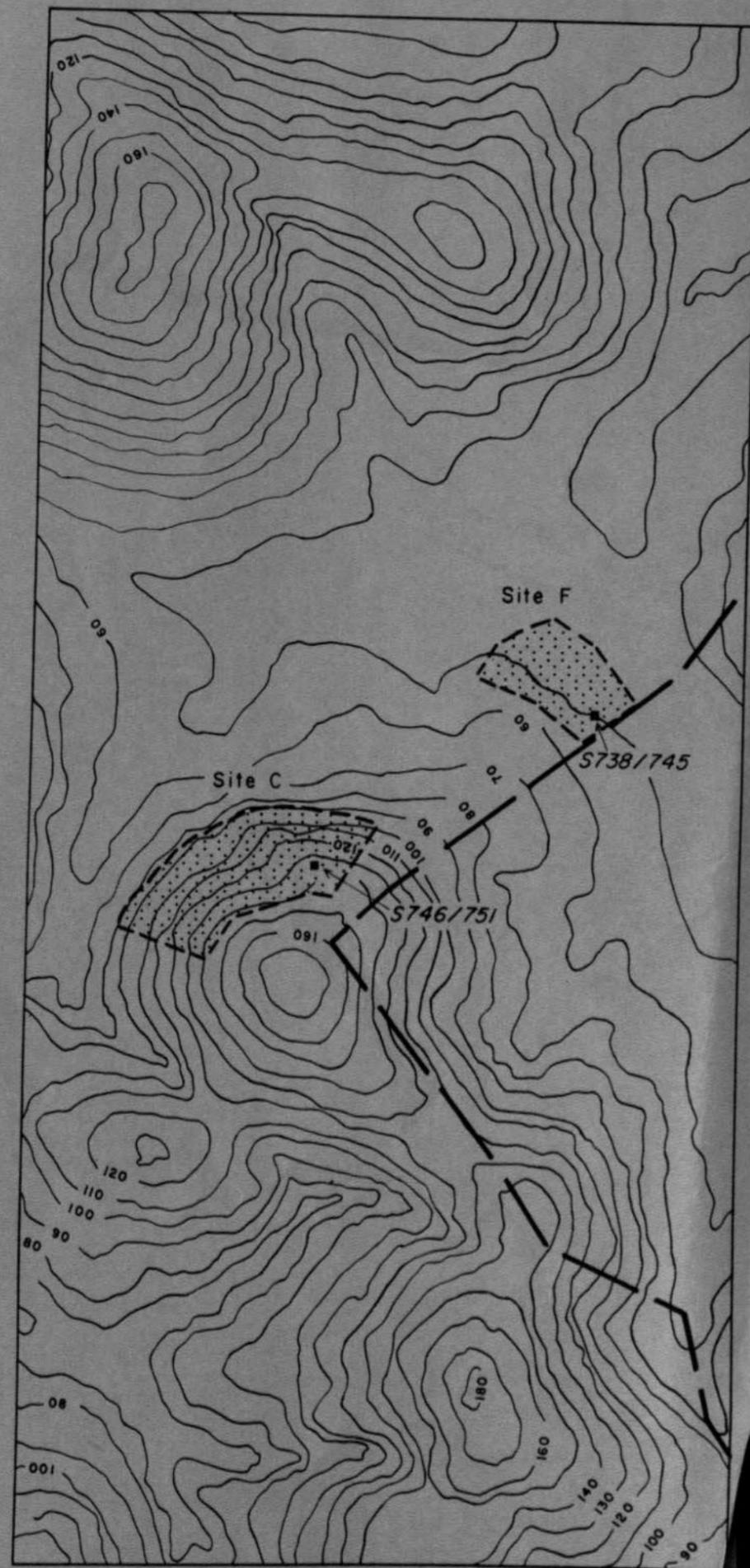
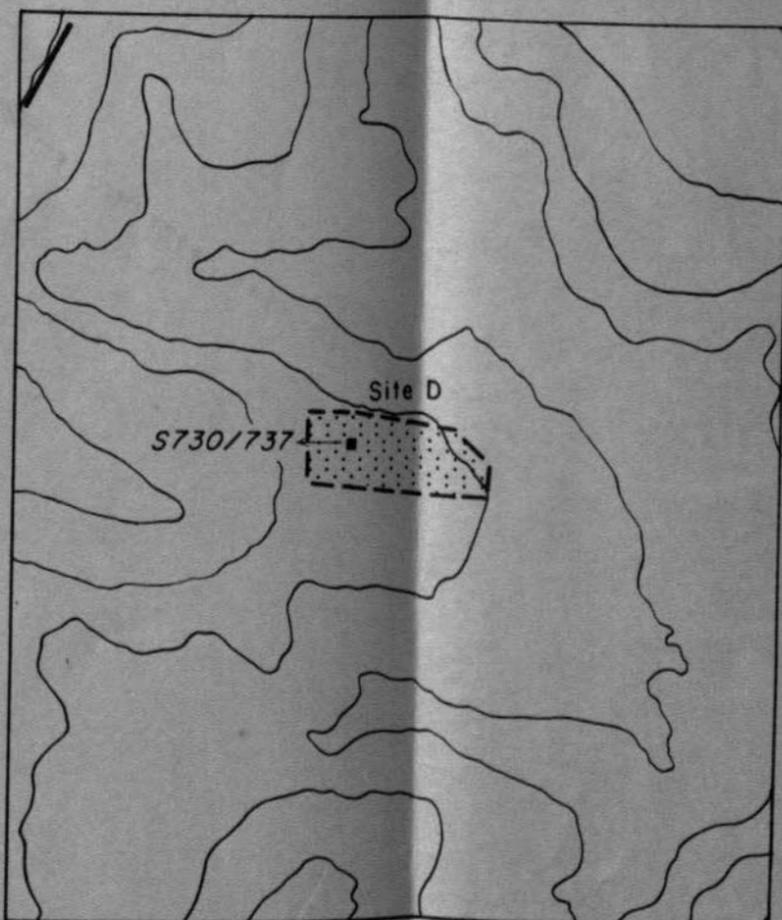
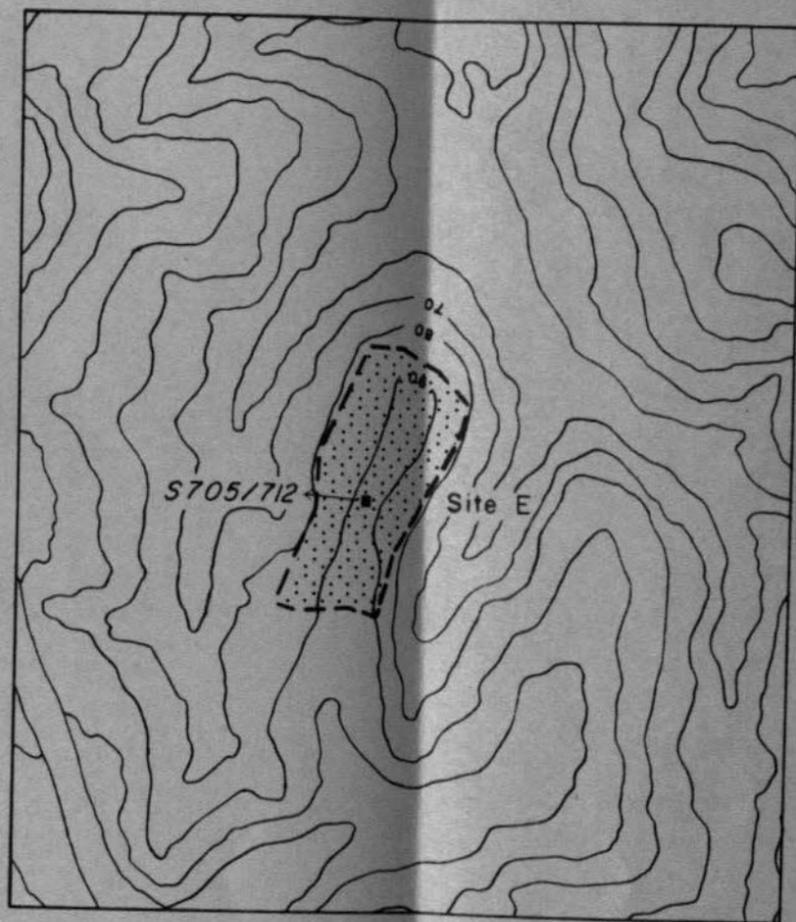
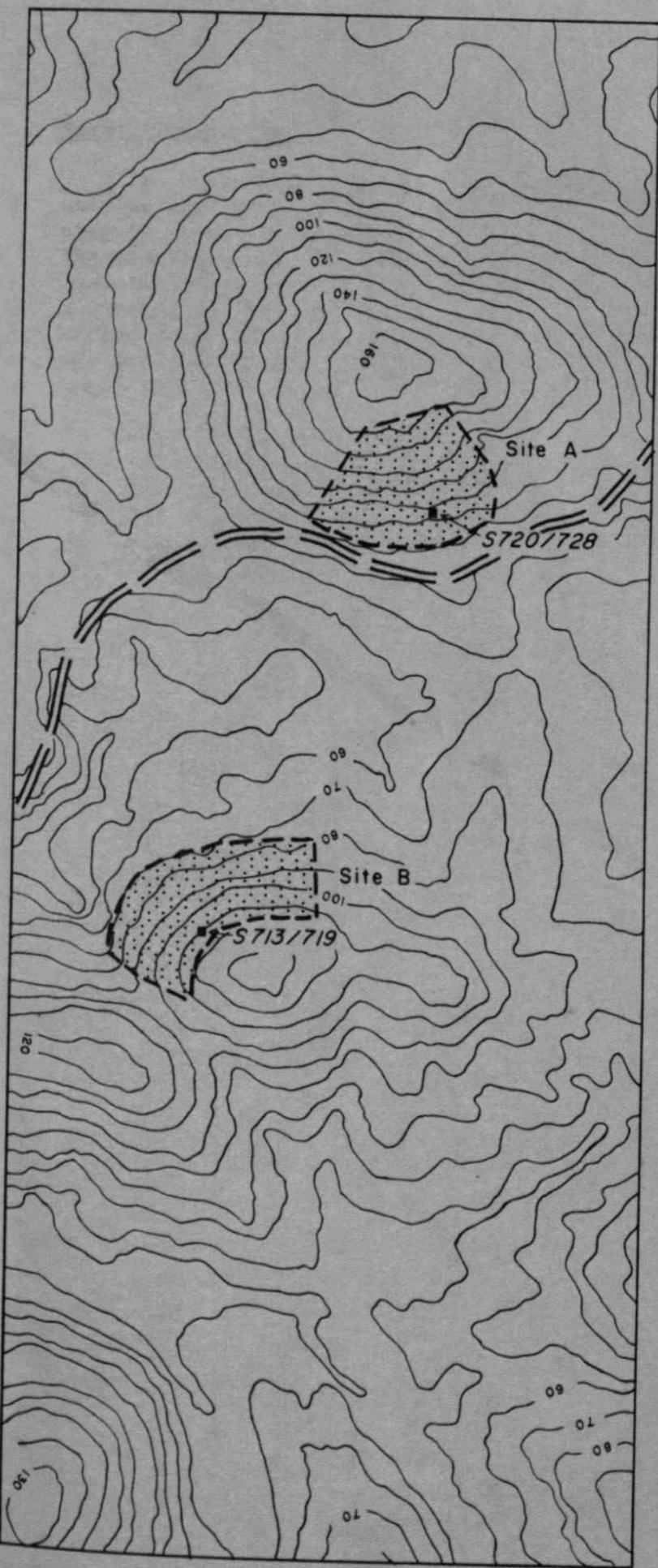


Fig. 1: SUGGESTED LOCATION OF EXPERIMENTAL SITES IN RELATION TO CONTOURS.

Merit Association

The Merit Association comprises imperfectly-drained to well-drained clays of the Merit Family together with less extensive clay loams of the Bekenu Family. Over much of the area where the association is present it grades into the Semadoh (Bandang) Association which is described below and boundaries are only approximate. Bandang Series may thus also occur in some areas mapped under the Merit Association on the soil map. In estimating the reliability of soil boundaries the position of the rentis lines should be noted.

Merit Family soils, where mapped in the west of the area in association with Nyalau soils, comprise brownish yellow clays or sandy clays which become rather firm and dense at depth and have many fine light grey mottles throughout the subsoil. They are of very minor extent in this part of the area and were not considered in siting suggested experiment plots.

Patches of soils classified in the Merit Family are quite extensive in the lowlands covering the northern half of the area. Here they are associated with the Bandang Series of the Semadoh Family and locally with Bekenu soils. Their distribution, according to rentis data, bears little relation to topography and their boundaries (shown as a dashed line on the soil map) is tentative only. Merit soils recorded at isolated single sampling points are included in the Semadoh (Bandang) Association.

Merit soils in this part of the area have variable characteristics. At some sites unmottled brownish yellow clays grade to strong brown clays at depth and gleyed horizons are found only below 36 inches and are then weakly expressed. Such soils lie fairly centrally within the concept of the Merit Family. At most other sites, however, the profile is heavily mottled, a multicoloured (reddish yellow, yellowish brown and grey) illuvial horizon is present but thin, and a strongly gleyed horizon is present within 30 inches of the surface. While by the present classification system these profiles must also be put in the Merit Family, it is apparent that they are closely linked to the Bandang Series into which they grade, and the profile form is probably due more to a lateritic than a podsollic process. Such soils, on further investigation, might be classed more appropriately in a family of Groundwater Laterite Soils rather than in the Red-Yellow Podsollic Soils as at present.

Site D is located on Merit soils in this mapping unit although it is doubtful if a 1-acre plot can be laid out without including some areas of Bandang soils, into which the Merit soils grade. As had been stated, the Merit soils here are generally atypical of the Family and experimental data from this site would have only doubtful relevance to other areas of Merit soils. A plot in this location would however give a comparison between these soils and the more highly leached Bandang soils, to which they are otherwise very similar.

Profile 4 in the Appendix (Field numbers S730/737 on the soil map) was sampled at Site D.

Saratok-Semadoh Association

The Saratok-Semadoh Association mantles low hills and spurs in the south of the survey area and is generally found between the Nyalau Association on the higher hills and the Plan Association in the bottomlands. The association appears to be underlain by mixed sandstones and shales, giving rise to Saratok and Semadoh soils respectively. It is probable, however, that many Saratok profiles are developed in colluvial wash from areas of Nyalau soils rather than from underlying sandstone.

Saratok soils in this mapping unit are generally pale brown, pale yellow or light grey sandy loams to sandy clay loams, grading to sandy clay loams at depth. Some silty loam profiles were also recorded. Yellow and yellowish brown mottles are commonly present at depth in the profile and may be scattered throughout. A stoneline of rotten quartz gravel may also occur.

Semadoh soils have a similar profile form but grade to sandy or silty clays at depth and may be clayey throughout the subsoil. At some sites, however, the profile is a friable clay loam to below 15 inches. These soils are commonly faintly mottled in the subsoil.

Both families have poor internal drainage and low chemical fertility. They have little agricultural potential without fertilizer applications. In this mapping unit they appear to occur in complex association and at a semi-detailed level of survey cannot be separated with ease. One site - Site E - was located where Semadoh soils appear to be continuous over a gently sloping interfluvial summit but elsewhere in this mapping unit further field work would be necessary to establish the soil pattern. Profile 5 in the Appendix (Field Numbers S705/712 on end maps) was sampled from Site E.

Semadoh (Bandang) Association

This mapping unit covers the gently undulating terrain which is largely mantled by soils of the Semadoh Family with minor occurrences of Saratok and Merit soils. Semadoh soils in this unit are sufficiently uniform (except for mottling) for them to be considered largely drainage phases of one series. Bandang Series has therefore been provisionally established to cover such soils.

Bandang Series consists of a dark greyish brown loam to clay loam well-rooted topsoil, rarely more than 2 inches in thickness and overlying very pale brown to light grey loam, silty loam or clay loam. This grades at depths of 18 to 30 inches to light grey clay or silty clay. Fine pale brown and brownish yellow mottles are commonly present in all subsoil horizons but the greatest concentration is normally at depths between 18 and 24 inches. In some profiles fine distinct manganous stains, possibly from manganese, were noted. The topsoil and upper subsoil is commonly friable and shows a weak, coarse or medium blocky structure. Below 18 inches, however, no structure is generally apparent, the soil being firm or even plastic (non-sticky) in the moist state. A feature of Bandang Series is the highly irregular boundaries of subsoil horizons.

Bandang Series has been limited to soils in which pale brown or paler matrix colours are present throughout the subsoil although a number of soils transitional between Bandang Series and those provisionally classified in the Merit Family occur in this mapping unit. These are very pale in colour below 24 inches but in the upper subsoil are multicoloured brown, yellow and grey. These are classified in the Semadoh Family if there is a continuous weakening of colour down the profile but are grouped with the Merit soils if there is a more strongly-coloured B horizon immediately above the gleyed horizons.

One site is suggested on Bandang Series in this mapping unit - Site F - located close to the eastern boundary of the nursery. A plot in this site, like that suggested at Site C, can most easily be reached through the Police Firing Range. Profile 6 in the Appendix (Field Numbers S738/745 on the Soil Map) was sampled at Site F.

Towards the bottomlands the Semadoh soils of this mapping unit grade into more heavily mottled clays which locally extend onto the bottomlands themselves and have been classified in the Malang Family. These soils cover a very restricted area.

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The remaining three soil association comprise poorly-drained soils on present bottomlands. The tree species on which present experiments are being planned are not considered suitable for such soils and no experimental plots have therefore been suggested for them. If Forest Department wishes to incorporate such soils in later experiments, areas of sufficiently uniform soil can be delimited with ease in the Mukah and Anderson Associations but not in the Plan Association.

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Plan Association

The Plan Association comprises poorly or very poorly-drained sands, sandy loams and sandy clay loams of the Plan and Bijat Families. Coarse-textured soils (Plan Family) are dominant as the association is found largely in minor stream valleys running from hills mantled by coarse-textured soils of the Nyalau and Saratok Families. Poorly-drained alluvial clays (Bijat Family) are of minor importance except in the centre of the area where the alluvial material is partly derived from shale uplands.

Plan Family soils comprise light grey to greenish or bluish grey sands and loams, commonly with a thin peaty or mucky topsoil (less than 6 inches in thickness). At the time of survey, and probably for much of the year, the water table was at, or within a few inches of, the surface in all Plan profiles examined.

Mukah Association

The Mukah Association is dominantly one of Mukah Family soils with minor admixtures of Bijat or Plan soils in smaller drainage grooves and on the margins of larger bottomlands. It probably includes some shallow Anderson Family soils in areas where it grades into the Anderson Association.

Mukah Family soils are shallow peats or mucks (between 6 inches and 3 feet in thickness) overlying strongly-gleyed mineral soil. In this area the underlying mineral horizons are largely grey or bluish-grey clays or silty clays. The water-table is at or near the surface at all times of the year.

Anderson Association

The Anderson Association comprises soils of the Anderson Family with possibly some minor inclusions of Mukah Family soils. Anderson Family soils are peats deeper than 3 feet. In this area only Anderson 1 soils - a depth phase covering peats 3 to 6 feet in thickness - were recorded. Anderson 2 soils - peats 6 to 10 feet in thickness - are inextensive if they occur at all. At the time of survey the watertable was above the surface throughout the area mapped under this association.

REFERENCES

1. WOLFENDEN, E.B. 1960 The geology and mineral resources of the lower Rajang valley and adjoining areas. British Borneo Geol. Survey Mem.11.
2. SCOTT, I.M. 1964 Report on a detailed soil survey of the Oya Road Agricultural Station, Third Division. (Report No.45/1) in this series.

APPENDIX

FORMAL PROFILE DESCRIPTIONS OF THE MAIN SOILS

In this section profiles sampled from the six suggested sites are described and the analytical data so far available is tabulated. Data on 'reserve' cations (conc. HCl extractable) are given as 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. The relevance of the chemical data given for forestry purposes is unknown.

The analytical data for the first two Nyalau Family profiles (Profiles 1 and 2) confirm the suggested correlation (p.6) with Likau Series mapped farther east on Oya Road Agricultural Station (Scott, 2). Profile 3 has a somewhat higher clay content throughout the profile and this is reflected in slightly higher 'reserve' and Group III elements.

The profile of Merit Family, Profile 4, appears to correlate with Lutong Series on the nearby Agricultural Station (Scott, 2).

Profiles of Bandang Series are characterised by a high silt content. 'Reserve' levels are comparable with profiles of Nyalau soils.

Classification of Bandang Series in the Low-humic Gley Soils is open to question. The analytical data confirm that a podsollic process is at least weakly expressed in the profile. There is an increase of clay with depth qualifying for an argillic horizon and chromas below the A1 horizon are 4 or less. In such soils placement in the Grey-White Podsollic or Low-Humic Gley soil groups depends on the presence or absence of a gley horizon within 24 inches of the surface. With the exception of the lowest horizon in Profile 6 all horizons of both profiles studied have less than 10 per cent Group III elements and, on comparison with soils over similar parent material elsewhere it is likely that iron compounds make up only a small percentage of this, it being largely aluminium. (Average Group III elements in Profiles 5 and 6 are 5.98 and 7.12 per cent respectively.) In such iron-poor material reducing and oxidising conditions have little effect on the soil colour and normal gley features cannot be expected. The heavy texture of the subsoil and the fact that the series is found on slopes of less than 5° and commonly on virtually flat terrain suggests, however, that the soil is saturated in the wet season and that conditions of poor drainage are more important than downward leaching in this soil.

Profile 1

Soil Group: Red-Yellow Podzolic Parent material: sandstone
Family: Nyalau External drainage: rapid
Series: Vegetation/land use: rasam and small trees
Phase: Altitude: 110 feet
Location: Oya Road forest
experimental nursery, rentis B Rainfall: c.126 inches
peg 3. Rainfall Class (Mohr): I
Latitude: 2° 17' N Lab. Nos: M.4158 - M.4165
Longitude: 112° 0' E Field Nos: S.720 - S.728
Site: middle slope of
moderately rolling country Date sampled: 1.6.65
Slope: 20 - 25°

- 0 - 3" Very dark greyish brown (10YR 3/2) fine sandy loam. Moist. Very weak medium subangular blocky structure. Friable. Abundant rootlets. Porous. Distinct smooth boundary. (M.4158).
- 3 - 11" Yellowish brown (10YR 5/6) fine sandy loam, with brown staining down root channels. Moist. Very weak coarse subangular blocky structure. Friable. Many rootlets. Porous. Indistinct root boundary. (M.4159).
- 11 - 20" Yellowish brown (10YR 5/8) fine sandy loam. Moist. Very weak coarse subangular blocky structure. Friable. Many rootlets. Porous. Gradual smooth boundary. (M.4160)
- 20 - 31" Sandy clay loam. Few rootlets. Otherwise as above. (M.4161)
- 31 - 40" Firm. Otherwise as above. (M.4162)
- 40 - 48" Yellowish brown to brownish yellow (10YR 5/8 - 6/8) sandy clay loam. Moist. Structureless. Friable. Rare rootlets. Porous. Gradual smooth boundary. (M.4163).
- 48 - 56" Yellowish brown (10YR 5/8) sandy clay loam, with many fine and medium distinct light yellowish brown mottles and few fine faint pink stains. Moist. Structureless. Friable. Porous. Indistinct wavy boundary. (M.4164).
- 56 - 72" Yellowish brown (10YR 5/8) sandy clay loam, with many medium and coarse distinct red mottles and many fine and medium light yellowish brown mottles. Moist. Structureless. Friable. Few rootlets. Porous. (M.4165).

Laboratory number	M.4158	M.4159	M.4160	M.4161	M.4162	M.4163	M.4164	M.4165
Upper depth of horizon (ins.)	0	3	11	20	31	40	48	56
Lower depth of horizon (ins.)	3	11	20	31	40	48	56	72
Horizon								
<u>PHYSICAL</u>								
Coarse earth (%)								
Fine earth								
Very coarse sand (%)	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Coarse sand (%)	4.0	3.1	2.2	3.9	2.4	3.0	2.5	2.7
Medium sand (%)	9.7	10.7	12.4	9.7	10.1	11.6	10.7	10.7
Fine sand (%)	32.4	33.2	33.2	33.4	33.0	32.1	33.0	30.3
Very fine sand (%)	11.1	12.7	11.7	12.0	12.5	11.4	9.7	11.1
Loss on ignition (%)	6.2							
Sand (%)	57.3	59.7	59.2	59.1	58.0	58.2	56.1	55.0
Silt (%)	21.3	22.0	21.1	20.7	19.7	20.6	21.2	21.2
Clay (%)	16.2	16.1	19.7	20.3	21.0	21.8	22.0	23.2

Table 1: Analysis of Profile 1: - Nyalau Family, (Site A)

Laboratory number Horizon	M.4158	M.4159	M.4160	M.4161	M.4162	M.4163	M.4164	M.4165
<u>CHEMICAL</u>								
pH (H2O; 1:2.5)	4.3	4.5	4.5	4.4	4.5	4.6	4.3	5.4
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								
Phosphorus (ppm)	95	60	55	55	43	45	55	50
Potassium (%)	0.09	0.12	0.14	0.13	0.13	0.17	0.17	0.24
Calcium (%)	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01
Magnesium (%)	0.03	0.04	0.04	0.04	0.04	0.06	0.04	0.05
Iron								
Aluminium								
Group III Elements (%)	5.10	6.20	7.20	7.60	7.75	8.00	8.80	8.60
Sulphates (Morgan's)								
Nitrogen (%)	0.01	0.06	0.03	0.02	0.01	0.01	0.01	0.02
Organic Carbon (%)	1.93	0.62	0.29	0.16	0.18	0.15	0.11	0.16
C/N Ratio	19.30	10.33	9.67	8.00	18.00	15.00	11.00	8.00

Table 1: (continued)

Profile 2

Soil Group: Red-Yellow Podzolic Parent material: sandstone
Family: Nyalau External drainage: rapid
Series: Vegetation/land use: scattered trees
Phase: Altitude: 110 feet
Location: Oya Road forest Rainfall: c.126 inches
experimental nursery, 100 yds Rainfall Class (Mohr): I
north east of present nursery Lab. Nos: M.4150 - M.4157
site Field Nos: S.713 - S.720
Latitude: 2° 17' N Date sampled: 1.6.65
Longitude: 112° 0' E
Site: Upper slope of moderately
rolling country.
Slope: 20°

- 0 - 2" Very dark greyish brown (10YR 3/2) fine sandy loam. Moist. Very weak fine granular structure. Very friable. Abundant roots and rootlets. Porous. Indistinct smooth boundary. (M.4150).
- 2 - 6" Very dark greyish brown, yellowish brown and very dark grey fine sandy loam. (Transitional horizon). Moist. Very weak medium granular structure. Friable. Many rootlets. Porous. Indistinct wavy boundary. (M.4151).
- 6 - 10" Yellowish brown (10YR 5/8) fine sandy loam with few fine faint light yellowish brown mottles and dark greyish brown staining down root channels. Moist. Structureless. Friable. Few rootlets. Porous. Gradual wavy boundary. (M.4152).
- 10 - 17" Light yellowish brown (10YR 5/8) fine sandy clay loam with greyish brown staining down root channels. Moist. Structureless. Friable. Few rootlets. Porous. Gradual wavy boundary. (M.4153).
- 17 - 30" Light yellowish brown (10YR 5/8) fine sandy clay loam. Moist. Structureless. Friable. Few rootlets. Porous. (M.4154).
- 30 - 39" As above. Gradual wavy boundary. (M.4155).
- 39 - 50" Fine sandy loam. Otherwise as above. Gradual wavy boundary. (M.4156).
- 50 - 58" Strong brown (7.5YR 5/8) sandy clay loam, with many medium faint reddish yellow mottles. Moist. Structureless. Friable. No roots seen. Porous. (M.4157).

Laboratory number	M.4150	M.4151	M.4152	M.4153	M.4154	M.4155	M.4156	M.4157
Upper depth of horizon (ins.)	0	2	6	10	17	30	39	50
Lower depth of horizon (ins.)	2	6	10	17	30	39	50	58
Horizon								
<u>PHYSICAL</u>								
Coarse earth (%)								
Fine earth								
Very coarse sand (%)	0.1	0.1	0.1	0.4	0.1	0.3	0.2	0.3
Coarse sand (%)	5.3	5.3	3.4	5.1	4.8	4.6	2.8	2.8
Medium sand (%)	7.6	9.8	11.4	8.6	8.5	8.7	9.8	10.0
Fine sand (%)	31.0	30.3	32.3	30.7	30.6	29.6	29.8	29.3
Very fine sand (%)	14.4	14.4	17.3	15.8	14.9	15.2	16.3	16.4
Loss on ignition (%)	6.7	4.6						
Sand (%)	58.3	59.9	64.5	60.6	58.9	58.4	58.9	58.8
Silt (%)	18.7	19.2	21.0	19.2	19.3	19.6	23.2	20.8
Clay (%)	14.3	14.7	15.4	18.1	20.3	20.1	19.2	20.4

Table 2: Analysis of Profile 2: - Nyalau Family (Site B)

Laboratory number	M.4150	M.4151	M.4152	M.4153	M.4154	M.4155	M.4156	M.4157
Horizon	4.3	4.6	4.5	4.7	4.8	4.9	4.8	4.2
<u>CHEMICAL</u>								
pH (H ₂ O; 1:2.5)								
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								
Phosphorus (ppm)	90	75	40	50	45	30	45	30
Potassium (%)	0.09	0.08	0.09	0.08	0.09	0.10	0.12	0.12
Calcium (%)	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Magnesium (%)	0.03	0.03	0.02	0.04	0.04	0.04	0.03	0.02
Iron								
Aluminum								
Group III Elements (%)	4.70	4.60	4.80	7.25	7.60	7.40	7.70	9.50
Sulphates (Morgan's)								
Nitrogen (%)	0.16	0.09	0.04	0.02	0.01	0.01	0.01	0.01
Organic Carbon (%)	1.97	1.43	0.48	0.26	0.18	0.15	0.11	0.10
C/N Ratio	12.31	15.89	12.00	13.00	18.00	15.00	11.00	10.00

Table 2: (continued)

Profile 3

Soil Group: Red-Yellow Podzolic Parent material: sandstone

Family: Nyalau

External drainage: rapid

Series:

Vegetation/land use: young regrowth

Phase:

Altitude: 130 feet

Location: Oya Rd. forest
experimental nursery, on hill
flank immediately south of
rentis C end point.

Rainfall: c.126 inches

Rainfall Class (Mohr): I

Latitude: 2° 17' N

Lab. Nos: M.4182 - M.4187

Longitude: 112° 0' E.

Field Nos: S.746 - S.751

Site: upper slope of moderately
rolling country.

Date sampled: 30.5.65

Slope: 20°

- 0 - 2" Very dark brown (10YR 2/2) sandy clay loam. Moist. Structureless. Friable. Abundant rootlets. Porous. Indistinct wavy boundary. (M.4182).
- 2 - 7" Yellowish brown (10YR 5/6) sandy clay loam, with few medium distinct yellow and pale brown mottles. Moist. Weak coarse subangular blocky structure. Friable. Many rootlets. Porous. Distinct wavy boundary. (M.4183).
- 7 - 16" Yellowish brown (10YR 5/8) sandy clay loam. Moist. Very weak medium subangular blocky structure. Friable. Few rootlets. Porous. Gradual wavy boundary. (M.4184)
- 16 - 24" Yellowish brown (10YR 5/8) sandy clay loam, with light yellowish brown staining down main cracks. Moist. Weak coarse subangular blocky structure. Friable. Many rootlets. Gradual wavy boundary. (M.4185).
- 24 - 29" Sandy clay loam. Otherwise as above. (M.4186).
- 29 - 45" As above. (M.4187).

	M.4182	M.4183	M.4184	M.4185	M.4186	M.4187
Laboratory number						
Upper depth of horizon (ins.)	0	2	7	16	24	29
Lower depth of horizon (ins.)	2	7	16	24	29	45
Horizon						
<u>PHYSICAL</u>						
Coarse earth (%)						
Fine earth						
Very coarse sand (%)	0.0	0.0	0.0	0.0	0.0	0.1
Coarse sand (%)	1.0	1.2	1.4	1.3	1.1	1.1
Medium sand (%)	5.7	5.5	7.4	5.7	5.7	5.0
Fine sand (%)	24.2	25.4	22.5	25.7	23.9	24.6
Very fine sand (%)	18.1	19.7	18.6	18.8	16.2	15.4
Loss on ignition (%)	9.4					
Sand (%)	48.0	51.7	50.0	51.4	46.8	46.1
Silt (%)	22.4	23.3	23.3	23.2	22.0	23.0
Clay (%)	20.5	23.1	25.1	26.3	29.1	29.6

Table 3: Analysis of Profile 3 - Nyalau Family (Site C)

Laboratory number Horizon	M. 4182	M. 4183	M. 4184	M. 4185	M. 4186	M. 4187
<u>CHEMICAL.</u>						
pH (H ₂ O; 1:2.5)	4.4	4.3	4.2	4.1	4.2	4.3
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						
Phosphorus (ppm)	145	85	75	75	75	75
Potassium (%)	0.10	0.10	0.11	0.12	0.12	0.15
Calcium (%)	0.04	0.02	0.01	0.02	0.02	0.02
Magnesium (%)	0.02	0.02	0.04	0.03	0.02	0.05
Iron						
Aluminium						
Group III Elements (%)	7.44	8.86	11.18	10.90	11.44	12.38
Sulphates (Morgan's)						
Nitrogen (%)	0.11	0.09	0.06	0.04	0.03	0.01
Organic Carbon (%)	3.91	1.24	0.41	0.22	0.24	0.11
C/N Ratio	35.55	13.78	6.83	5.50	8.00	11.00

Table 3: (continued)

Profile 4.

Soil Group: Red-Yellow Podzolic Parent material: shale
Family: Merit External drainage: slow
Series: Vegetation/land use: poor regrowth
Phase: Altitude: 45 feet.
Location: Oya Rd. forest Rainfall: c.126 inches
 experimental nursery, Rainfall Class (Mohr): I
 rentis D, peg 9.
Latitude: 2° 17' N Lab. Nos: M.4166 - M.4173
Longitude: 112° 0' E Field Nos: S.730 - S.737
Site: summit of gently rolling Date sampled: 1.6.65
 hill.
Slope: 2°

- 0 - 2" Greyish brown (10YR 5/3) silt loam. Moist.
Structureless. Friable. Abundant rootlets.
Porous. Indistinct wavy boundary. (M.4166).
- 2 - 6" Dark greyish brown (10YR 4/2) silt loam. Moist. Very
weak medium angular blocky structure. Friable.
Many rootlets. Porous. Distinct irregular
boundary. (M.4167).
- 6 - 8/10" Strong brown (7.5YR 5/6) and very pale brown (10YR 7/3)
silty clay loam. Moist. Weak medium angular blocky
structure. Firm. Rare vertical cracks with clay
skins. Few rootlets. Indistinct wavy boundary. (M.4168)
- 8/10-13/17" Yellowish red (5Y 5/8) silty clay loam, with many
coarse distinct very pale brown and few fine distinct light
grey mottles. Moist. Coarse angular blocky
structure with vertical cracks as horizon above.
Firm. Few rootlets. Gradual wavy boundary. (M.4169).
- 13/17-17/24" Silty clay, light grey mottles many fine and medium
distinct. Otherwise as above. Gradual irregular boundary.
(M.4170)
- 17/24-25/28" Very pale brown, light grey and yellowish red coarsely
mottled silty clay. Otherwise as above. Gradual
irregular boundary. (M.4171).
- 25/28-34/46" Light grey (10YR 7/1) clay with profuse fine distinct
brownish yellow and red mottles. Moist. Vertical
cracks but no other structure apparent. Firm.
No roots seen. Gradual irregular boundary. (M.4172)
- 34/46 - 50" As above, mottles many only. (M.4173)

Laboratory number	M.4166	M.4167	M.4168	M.4169	M.4170	M.4171	M.4172	M.4173
Upper depth of horizon (ins.)	0	2	6	8/10	13/17	17/24	25/28	34/46
Lower depth of horizon (ins.)	2	6	8/10	13/17	17/24	25/28	34/46	50
Horizon								
<u>PHYSICAL</u>								
Coarse earth (%)								
Fine earth								
Very coarse sand (%)	0.0	0.0	0.3	0.2	0.1	0.0	0.0	0.0
Coarse sand (%)	0.2	0.4	0.9	0.7	0.3	0.1	0.1	0.1
Medium sand (%)	1.0	1.1	1.0	0.7	0.3	0.1	0.1	0.2
Fine sand (%)	4.3	4.1	3.1	2.9	1.3	0.3	1.5	1.6
Very fine sand (%)	5.7	5.5	5.1	5.1	2.3	0.7	0.9	1.1
Loss on ignition (%)		4.5						
Sand (%)	11.2	11.1	10.4	9.6	4.3	1.1	2.7	3.0
Silt (%)	76.4	69.5	65.4	61.9	47.8	49.8	38.4	40.1
Clay (%)	10.6	14.8	24.3	29.6	49.9	51.0	60.9	59.0

Table 4: Analysis of Profile 4 - Merit Family (Site D)

Laboratory number Horizon	M.4166	M.4167	M.4168	M.4169	M.4170	M.4171	M.4172	M.4173
<u>CHEMICAL</u>								
pH (H ₂ O; 1:2.5)	4.6	4.4	4.1	4.2	4.1	4.3	4.3	4.4
CaCO ₃ (%)								
Exchangeable (Meq./100 gm)								
Calcium			115	105	115	125	110	150
Magnesium			0.31	0.32	0.53	0.75	0.78	0.77
Potassium			0.03	0.01	0.01	0.01	0.01	0.04
Sodium			0.06	0.08	0.12	0.10	0.11	0.12
Total bases (Meq./100 gm)								
C.E.C. (Meq./100 gm)								
% base saturation								
Phosphorus (available)								
P-retention (%)								
Conc. HCl Extractable								
Phosphorus (ppm)								
Potassium (%)	120	130	115	105	115	125	110	150
Calcium (%)	0.20	0.21	0.31	0.32	0.53	0.75	0.78	0.77
Magnesium (%)	0.03	0.02	0.03	0.01	0.01	0.01	0.01	0.04
Iron	0.04	0.04	0.06	0.08	0.12	0.10	0.11	0.12
Aluminium								
Group III Elements (%)	3.50	3.46	5.50	5.82	11.52	15.20	16.68	11.78
Sulphates (Morgan's)								
Nitrogen (%)	0.03	0.04	0.04	0.07	0.10	0.11	0.13	0.11
Organic Carbon (%)	1.68	1.58	0.36	0.22	0.27	0.27	0.27	0.22
C/N Ratio	56.00	39.50	9.00	3.14	2.70	2.45	2.08	2.00

Table 4: (continued)

Profile 5

Soil Group: Low Humic Gley

Parent material: shale

Family: Semadoh

External drainage: moderately rapid

Series: Bandang

Vegetation/Land Use: young regrowth

Phase:

Altitude: 92 feet

Location: 300 yds. NW of mile
12, Oya road.

Rainfall: c.126 inches

Latitude: 2° 17' N

Rainfall Class (Mohr): I

Longitude: 112° 0' E

Lab. Nos: M.4142 - M.4149

Site: summit of gently rolling
country

Field Nos: S.705 - S.712

Date sampled: 1.6.65

Slope: 2°

- 0 - 2" Dark greyish brown (10YR 4/2) loam. Moist. Structureless. Friable. Abundant rootlets. Porous. Indistinct wavy boundary. (M.4142).
- 2 - 5" Greyish brown (10YR 5/2) loam. Moist. Structureless. Friable. Many rootlets. Porous. Indistinct irregular boundary. (M.4143).
- 5 - 8" Very pale brown (10YR 7/4) loam, with many medium faint yellow and light grey mottles. Moist. Structureless. Slightly friable. Many rootlets. Porous. Indistinct wavy boundary. (M.4144).
- 8 - 14" Very pale brown (10YR 7/4) loam, with many medium and coarse distinct yellow brown and light grey mottles. Moist. Very weak coarse subangular blocky structure. Friable. Few rootlets. Gradual wavy boundary. (M.4145).
- 14 - 23" Very pale brown (10YR 7/4) to pale yellow (2.5Y 7/4) loam, with many medium and fine faint yellow and light grey mottles. Moist. Very weak coarse subangular blocky structure. Friable. Few rootlets. Gradual wavy boundary. (M.4146).
- 23 - 34" Very pale brown, strong brown and light brownish grey clay loam. Moist. Very weak coarse subangular blocky structure. Friable. Few rootlets. Gradual wavy boundary. (M.4147).
- 34 - 45" Light brownish grey (2.5Y 6/2) clay loam with many coarse distinct yellowish brown and light grey mottles. Moist. Very weak coarse subangular blocky structure. Gradual wavy boundary. (M.4148).
- 45 - 54" Light grey (10YR 7/2) silty clay loam, with many fine distinct yellowish brown mottles and grey bands from weathered shale. Moist. Structureless. Friable. Rare rootlets. (M.4149).

Laboratory number	M.41142	M.41143	M.41144	M.41145	M.41146	M.41147	M.41148	M.41149
Upper depth of horizon (ins.)	0	2	5	8	14	23	34	45
Lower depth of horizon (ins.)	2	5	8	14	23	34	45	54
Horizon								
<u>PHYSICAL</u>								
Coarse earth (%)								
Fine earth								
Very coarse sand (%)	0.0	0.0	0.0	0.1	0.0	0.3	0.1	0.0
Coarse sand (%)	3.3	3.1	0.7	2.3	0.7	3.0	1.1	0.1
Medium sand (%)	4.3	3.9	5.5	4.1	4.5	2.0	1.0	0.4
Fine sand (%)	20.9	21.3	21.7	20.8	20.8	14.6	9.3	7.5
Very fine sand (%)	16.1	16.9	18.3	17.0	16.4	13.2	10.4	8.8
Loss on ignition (%)	6.0							
Sand (%)	44.6	45.4	46.2	44.3	42.3	33.1	21.9	16.8
Silt (%)	36.5	36.0	35.1	36.9	36.8	36.4	43.7	54.6
Clay (%)	14.8	17.7	17.0	18.4	21.9	30.8	35.6	30.2

Table 5: Analysis of Profile 5 - Bandang Series, Semaduh Family

(Site E)

Laboratory number	M.41142	M.41143	M.41144	M.41145	M.41146	M.41147	M.41148	M.41149
Horizon	4.5	4.5	4.6	4.5	4.6	4.7	4.8	4.7
<u>CHEMICAL</u>								
pH (H ₂ O; 1:2.5)								
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								
Phosphorus (ppm)	85	80	70	70	80	90	100	90
Potassium (%)	0.18	0.19	0.22	0.18	0.24	0.35	0.53	0.61
Calcium (%)	0.03	0.02	0.03	0.01	0.02	0.02	0.02	0.03
Magnesium (%)	0.05	0.06	0.06	0.07	0.08	0.10	0.14	0.11
Iron								
Aluminium								
Group III Elements (%)	2.50	3.65	4.00	3.10	5.00	6.70	8.35	7.30
Sulphates (Morgan's)								
Nitrogen (%)	0.11	0.09	0.05	0.04	0.08	0.06	0.04	0.08
Organic Carbon (%)	1.65	1.24	0.43	0.31	0.21	0.21	0.24	0.44
C/N ratio	15.00	13.78	8.60	7.75	2.63	3.50	6.00	5.50

Table 5: (continued)

Profile 6.

Soil Group: Low Humic Gley Parent material: shale
Family: Semadoh External drainage: slow
Series: Bandang Vegetation/land use: young regrowth
Phase: Altitude: 50 feet
Location: Oya Rd. forest Rainfall: c.126 inches
 experimental nursery, rentis C,
 peg 30½. Rainfall Class (Mohr): I
Latitude: 2° 17' N Lab. Nos: M.4174 - M.4181
Longitude: 112° 0' E Field Nos: S.738 - S.745
Site: gently sloping footslope. Date sampled: 1.6.65
Slope: 4°

- 0 - 2" Dark greyish brown (10YR 4/2) silt loam. Moist. Very weak fine granular structure. Friable. Abundant roots and rootlets. Porous. Distinct smooth boundary. (M.4174).
- 2 - 6" Greyish brown (10YR 5/2) silt loam. Moist. Weak coarse subangular blocky structure. Friable. Many rootlets. Porous. Distinct broken boundary. (M.4175).
- 6 - 7/10" Light grey (10YR 7/2) silt loam. Patches of the second horizon down main root channels. Moist. Weak coarse subangular blocky structure. Friable. Few rootlets. Porous. Indistinct irregular boundary. (M.4176).
- 7/10-14/18" Light grey (10YR 7/1) silt loam, with many fine distinct pale brown and yellow mottles and few medium distinct mauve stains. Moist. Very weak coarse subangular blocky structure. Friable. Few roots. Porous. Gradual wavy boundary. (M.4177).
- 14/18-18/25" Light grey (5Y 7/1) silt loam, with many medium distinct pale brown mottles and many coarse distinct rusty root channels. Moist. Structureless. Firm. Rare roots. Gradual wavy boundary. (M.4178).
- 18/25-22/31" Light grey (5Y 7/1) silt loam, with many coarse distinct pale brown and yellow mottles and few medium distinct rusty root channels. Moist. Structureless. Firm. Rare rootlets. Gradual irregular boundary. (M.4179).
- 22/31-32/45" Light grey (5Y 7/1) silty clay loam, with many medium faint very pale brown mottles and some dark brown staining down root channels. Moist. Structureless. Firm. Rare rootlets. Gradual irregular boundary. (M.4180).
- 32/45-54" Light grey (5Y 7/2) silty clay, with few fine faint very pale brown mottles. Otherwise as above. (M.4181).

Laboratory number	M.4174	M.4175	M.4176	M.4177	M.4178	M.4179	M.4180	M.4181
Upper depth of horizon (ins.)	0	2	6	7/10	14/18	18/25	22/31	32/45
Lower depth of horizon (ins.)	2	6	7/10	14/18	18/25	22/31	32/45	54
Horizon								
<u>PHYSICAL</u>								
Coarse earth (%)								
Fine earth								
Very coarse sand (%)	0.0	0.0	0.0	0.1	0.2	0.1	0.0	0.0
Coarse sand (%)	0.3	0.7	1.0	0.7	0.4	0.3	0.1	0.2
Medium sand (%)	2.1	2.7	2.7	2.3	1.6	1.4	0.4	0.8
Fine sand (%)	10.0	10.2	12.0	10.4	8.8	7.7	3.1	3.0
Very fine sand (%)	17.9	18.4	18.1	16.9	16.3	14.1	10.7	5.4
Loss on ignition (%)	6.2							
Sand (%)	30.3	32.0	33.7	30.4	27.2	23.6	14.3	9.3
Silt (%)	53.1	54.6	52.5	54.4	53.5	50.6	48.0	49.8
Clay (%)	12.4	12.8	14.1	14.2	20.3	26.6	38.1	43.0

Table 6: Analysis of Profile 6 - Bandang Series, Semaduh Family

(Site F)

Laboratory number	M.4174	M.4175	M.4176	M.4177	M.4178	M.4179	M.4180	M.4181
Horizon	4.0	4.3	4.4	4.4	6.1	4.2	4.2	4.1
<u>CHEMICAL</u>								
pH (H ₂ O; 1:2.5)								
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								
Phosphorus (ppm)	100	85	70	65	70	55	110	115
Potassium (%)	0.14	0.16	0.20	0.16	0.26	0.34	0.53	0.72
Calcium (%)	0.02	0.03	0.01	0.01	0.01	0.02	0.02	0.02
Magnesium (%)	0.02	0.04	0.04	0.02	0.05	0.07	0.04	0.04
Iron								
Aluminium								
Group III Elements (%)	1.70	2.34	2.88	3.00	4.34	6.28	9.30	11.38
Sulphates (Morgan's)								
Nitrogen (%)	0.18	0.13	0.06	0.03	0.06	0.07	0.06	0.06
Organic Carbon (%)	2.41	1.40	0.70	0.27	0.10	0.08	0.38	0.32
C/N Ratio	13.39	10.77	11.67	9.00	1.67	1.14	6.33	5.33

Table 6: (Continued)

FOREST EXPERIMENTAL
NURSERY; OYA RD.

MAP 2: SOILS

KEY

MAPPING SYMBOL	SOIL ASSOCIATION	MAIN CHARACTERISTICS	SUITABILITY FOR FOREST EXPERIMENTAL WORK	APPROXIMATE ACREAGE
	NYLAU	Yellowish brown, sandy loams, clay loams and sandy clays. Derived from sandstones. Deep, well drained. On moderately sloping country.	Good. Widely represented in the country and generally fairly uniform in character where present.	129
	MERIT	Imperfectly drained clays. Derived from shales. On gently sloping lowlands.	Doubtful. The Merit Family is widespread but soils here cover a small acreage and are shallow.	21
	SARATOK-SEMADOH	Red coloured, poorly drained soils of variable texture. Derived from sandstones and shales. Very low fertility. On gently sloping country.	Doubtful. Widely represented but character in this locality possibly too variable to allow interpretation of experimental results. Require further study.	74
	BANDANG Series (Semadoh Family)	Imperfectly to poorly drained clays. Derived from shales. On gently sloping lowlands.	Good. Drainage condition variable but other characteristics fairly uniform. Widely represented although rarely covering a large acreage.	194
	PLAN	Clayey textured soils, heavy soils. Derived from shales. On steeply sloping lowlands.	Unsuitable except for species able to withstand almost continual waterlogging of the soils.	17
	MUKAH	6 to 36 inches deep (or more) overlying greyed clay (or) sandy clays.		31
	ANDERSON	Organic soils more than 36 inches deep (or) more than 6 feet.		28

- Disturbed land
- Soil boundary
- Approximate soil boundary
- Rents
- Profile pit (with sample field numbers)
- Main road
- Minor road
- Boundary of survey area

LOCATION

