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KENYA SOIL SURVEY

SOME PRELIMINARY NOTES ON THE SOILS OF KATUMANI, KAMPI
YA MAWE, EMBU AND MURINDUKO AGRICULTURAL RESEARCH STATION

b y

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and

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SITE EVALUATION REPORT

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Kenya Soil Survey

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SOME PRELIMINARY NOTES ON THE SOILS OF KATUMANI, KAMPI YA MAWE, EMBU AND MURINDUKO AGRICULTURAL RESEARCH STATIONS.

by

J.P. Mbuvi

and

R.F. Van de Weg.

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Site evaluation No. 25

Some Preliminary Notes on the Soils of Katumani, Kampi
ya Mawe, Embu and Murinduko Agricultural Research Stations

J.P. Mbuvi and R.F. Van de Weg

1. INTRODUCTION

Visits were paid to Katumani, Embu and Murinduko Stations with the aim of comparing the soils of these research stations in the Eastern Province with those of Kindaruma area (sheet 136⁺) and to assess how far the trial results from the stations are applicable to aforementioned surveyed area. During the visits several pits and augerholes were described and sampled for analysis.

In Kampi ya Mawe station, a detailed soil survey at scale 1:2500 was carried out (Muchena, 1974). The map is available at the Kenya Soil Survey Offices, NAL - Nairobi. For Katumani also a survey has been carried out, for similar purposes but the analytical data are incomplete and the relevant map is lost. (Musuva, 1968)

2. KATUMANI

Katumani Agricultural Research Station lies approximately 10 km South west of Masaku town on the Masaku-Makueni-Kilungu road. It lies at an altitude of 1575m above sea level. Katumani was started in 1955 as a research centre to help in finding out crops suitable for the medium-potential areas especially in the Eastern Province where rainfall distribution and reliability is poor. The station occupies 273 ha of which 92 ha is cultivated, the rest is under grazing or is used for buildings.

2.1. Climate

Rainfall data are available for the station (EAMD, 1973). The following table gives the average rainfall during both wet and dry seasons. The averages are obtained from monthly statistics (13 years average).
Average seasonal and annual rainfall in mm for Katumani station:

Long dry season	Short rains	Short dry seasons	Long rains	Year
June - Sept.	Oct. - Dec.	Jan. - Feb.	Mar. - May	
19	319	81	307	725

⁺Covered by reconnaissance soil map, Kenya Soil Survey, 1974

The difference between the wet and dry seasons is quite conspicuous, since the station (and the area in general) has very low rainfall especially in the long dry season. (see Braun, 1975)

The annual potential evaporation (E_o) is in the order of 1900mm (Woodhead, 1968). The ratio average rainfall/ E_o (r/E_o) then is 38%, thus placing the area in ecological zone IVb (Woodhead, 1970 and Survey of Kenya, 1970).

2.2. Geology

The area consists of Pre-Cambrian Basement System rocks: quartzo-felspathic gneisses. This group includes a variable range of gneisses which are poor in ferro-magnesian minerals. (Baker, 1954). The area is undulating uplands with flat-topped interfluvies. Numerous gullies drain to Kimutwa River which forms the southeastern boundary of the station. The Potha river on the West, towards the Kapiti plain, drains the Western part of the station. Both rivers have some water flow all the year round.

2.3. Soils

In the station the following three soil units are found:

- (a) Soil unit 1 The predominant soils are reddish ones; they are in general well drained. On the gently undulating to undulating areas (< 8% slope) the soils are deep to very deep with the colours ranging from dark red (2.5YR 3/6) to dark reddish brown (2.5YR 3/4) when moist. They are hard when dry and friable to firm when moist, with structures of porous massive falling apart to weak sub-angular blocky in the lower horizons. These soils have clay texture throughout the profile; they tend to seal at the surface. On the ridge slopes which are rolling (slopes 8-13%) the soils have to some extent been eroded and so are shallow to moderately deep over bedrock. These soils contain few weatherable primary minerals: (For a representative profile pit see appendix; pit no. 162/1-3). The soils are slightly acid with a $pH-H_2O$ (1:1 suspension) 5.8-6.5 and $pH-KCl$ 4.8-5.2. These soils are fair to poor in plant nutrients, i.e. Calcium, Potassium and Magnesium and deficient in Nitrogen and Phosphorus. The clay in these soils is poorly crystallised illite and metahallosysite as the main components.

These soils compare well to the soils found in the Kindaruma area, soil mapping unit BUrc1 which are also developed on undifferentiated Basement System rocks, predominantly banded gneisses. These soils are well drained, deep, dark red to dark reddish brown, friable to firm (compact) clay, and are classified as FERRAL - chromic LUVISOLS .

- (b) Soil Unit 2 Except for the colour and depth the brownish soils resemble the reddish soils, however on the ridge slopes they are shallow to very shallow, in most places less than 15 cm. deep. The brown soils have illite constituting about 62% and kaolin 38%. The average C.E.C. and base saturation from these soils is 13 and 15.3 and 68.5 and 81.2 for the A and B horizons respectively.
- (c) Soil Unit 3 Black soils cover a very small percentage of the station. In common with other cracking black clays the drainage is imperfectly to poor. They are moderately deep, with black colour (10YR 2.5/1) changing to dark grey in the lower horizon (10YR 3/1). The structure is prismatic to coarse blocky. The profile contains free lime from 10 cm. downwards and increasing percentage of calcium carbonate concretions with depth (up to 15%). The texture is heavy clay throughout. These soils can be classified as pellic VERTISOLS.

3. KAMPI YA MAWE

Kampi ya Mawe is a substation for Katumani research station though it started before Katumani itself. It is situated in the Northern Division of Masaku District at an altitude of 1125 m above sea level. The area has more or less the same rainfall pattern as Katumani station.

3.1. Climate

Rainfall data for the station and Makueni-Athi camp are available (EAMD, 1973). The following table shows the average rainfall breakdown for the two stations in mm (17 and 11 years respectively).

	long dry season June - Sept.	short rains Oct. - Dec.	short dry seasons Jan. - Feb	long rain Mar-May	year -
Kampi ya Mawe	27	354	77	268	725
Makueni-Athi- Camp	11	378	76	220	684

From the above figures Kampi ya Mawe like Katumani has hardly any rainfall during the long dry season; also the short rains feature more prominently than the long rains. The annual potential evaporation (E_o) for Kampi ya Mawe and Makueni is 2000 mm and 2050 mm respectively; thus the area is situated in ecological zone IV b (Woodhead, 1970 and Survey of Kenya, 1970). Although Kampi ya Mawe and Katumani have equal average yearly rainfall the former has a slightly higher annual potential evaporation.

3.2. Geology

The area consists of Precambrian Basement System rocks (Dodson, 1953), predominantly biotite gneisses except the south west corner of the station which is underlain by granitoid gneisses.

3.3 Soils

In the station the following soil types are found:

(a) Mumbuni and Muvau series

These are well drained, deep to very deep, dark reddish brown to red, friable to very friable clays.

(b) Malibani, Ngosini and Mwaani series

These soils (which cover the largest portion of the station) are well drained and vary from shallow to moderately deep to deep and very deep. The Malibani and Mwaani series are shallow to moderately deep over petroplinthite (murram), the Ngosini series are however deep. The consistence varies from friable to firm. There is a range of textures from sandy clay loam to fine sandy clay and clay.

(c) Kampi ya Mawe series

These soils cover a minor part of the station (South-western part). They are well drained; have loamy sand textures and vary from shallow to deep with yellowish brown colours. The moderately deep soils lie over petroplinthite (murram) while the really shallow one lie over rock. The area which is covered by these soils is used for grazing only.

In general it can be said that the greater portion of Kampi ya Mawe station is covered by shallow to moderately deep soils. For details on the soils of this station one is referred to the report accompanying the map (Muchena, 1974)

4. EMBU AND MURINDUKO:

Embu Research Station lies 3 km North-west of Embu town at 1463m above sea level. The station was started in 1961. Apart from the main station there are two other substations, Murinduko, 6 km S.W. of Embu town at 1279m above sea level and Gituamba in Central Province at 1980m above sea level. Gituamba is reported separately⁺. The main station is 69 ha and Murinduko is 18 ha.

4.1. Climate

Rainfall data are available for Embu Agricultural Institute (next to Embu Research Station), Embu town and Murinduko sub-station (EAMD, 1973). The following table gives the average rainfall for these stations during wet and dry seasons. The averages are obtained from

+ Detailed soil survey by O. Oswago, Kenya Soil Survey, 1975

monthly statistics (27 years Embu A.I; 63 years Embu town and 15 years Murinduko.

Average seasonal and annual rainfall in mm for the three stations:

	Long dry season June - Sept.	short rains Oct. - Dec.	Short dry season Jan. - Feb.	Long rains Mar. - May	Year -
Embu A.I.	157	417	48	616	1238
Embu town	109	374	50	539	1060
Murinduko	66	387	62	519	1032

There is a marked difference between the wet and dry seasons as can be seen from the above figures. The annual potential evaporation (E_o) is 1800 mm (Woodhead, 1968). The ratio average rainfall/ E_o (r/E_o) for Embu A.I, Embu town and Murinduko then is 69%, 59% and 57% respectively. This puts Embu Research Station in ecological zone II and Murinduko in III a (Woodhead, 1970) and Survey of Kenya, 1970).

4.2. Geology

The area consists of Mount Kenya Phonolite (Kenyte). The porphyritic phonolites contain anorthoclase feldspar and nepheline. (Fairburn, 1966).

4.3. Soils - Embu Station

In the main station the two "blocks" have uniform soils. The soils are well drained, very deep, dark reddish brown (2.5YR 3/4). They are hard to slightly hard when dry and friable when moist, with a porous massive to weak sub-angular blocky structure. These soils have clay texture throughout the profile (for a representative profile pit, see appendix; pit no. 135/2-6).

Although ecological zone II of Embu Res. Station does not occur in the Kindaruma area, the soils are to some extent comparable to mapping unit Bfrc which is developed on the fine textured Basement System rocks rich in ferromagnesian minerals. These soils are well drained, deep, dark red friable to firm (compact) clay.

The soils are slightly acidic to neutral with a pH- H_2O , 1:1 suspension 6.3 - 6.6 and pH-KCl 5.3 - 6.2 (topsoil). The soils are rich in plant nutrients except phosphorus and nitrogen which are in deficient. The clay in these soils is 100% kaolinite. The CEC is 22.4 and 18.0 for the A and B horizons and the base saturation is 71.6 and 81.7 respectively. These soils are classified as eutric Nitosols.

4.3.1. Soils - Murinduko substation

In Murinduko substation the following two soil units were found:-

- (a) Soil Unit 1 These soils are well drained, very deep, dark reddish brown (2.5YR 3/4), clays. They are hard to slightly hard when dry but friable to very friable when moist. /6

The soils have porous massive structure. The two plots close to the hill have a sandy clay texture in the topsoil which is most likely due to material washed down from the hill. For a representative profile pit, see appendix; pit no. 135/2-2. These red soils occupy 2/3 of the station. They compare with soils found in Kindaruma area, soil mapping unit VKr which are developed on the same volcanic rocks (kenyte). These soils are also well drained, deep, dark red, very friable clays and are classified as rhodic FERRALSOLS,

These soils are slightly acidic pH-H₂O (1:1 suspension) 4.9 - 6.2 and pH KCl 4.0 - 5.2. The soils are deficient in phosphorus and nitrogen, sufficient in potassium, calcium, magnesium and manganese, while the percentage carbon (C%) is fair to high. The clay in these soils is predominantly kaolinite. The C.E.C. is 17.2 and 13.6 for the A and B horizons and the base saturation is 54.6 and 41.4 respectively.

- (b) Soil unit 2 These are brownish soils which occupy only a minor portion in the "depressional area" of the station. (The greater portion of which is occupied by a pond). The soils are well drained and in general moderately deep with yellowish-red colours (5YR 4/8). They are hard when dry and friable when moist, with sub-angular to angular blocky structure. The texture is clay throughout.

CONCLUSIONS & RECOMMENDATIONS

From the above information it appears that trial results from both Katumani Research Station and Kampi ya Mawe substation can well be applied in a rather large area of Kindaruma both as regards the soils and the climate. Trial results from Murinduko Station could be extrapolated to the soil unit VKr of the Kindaruma area. This soil unit however forms only a small portion of the sheet ^{and is} not really very representative. As mentioned earlier Embu falls in ecological zone II which does not occur in the Kindaruma area. This makes the extrapolation of trial results from the Embu station to the Kindaruma area difficult if not impossible. Trial results from Embu station will be applicable only to areas with higher rainfall, and with a better distribution over the year.

6, REFERENCES:

1. Baker, B.H. 1954 Geology of southern Machakos District (with coloured map) report no. 27. Geological Survey of Kenya, Nairobi.
2. Braun, H.M.H. Seasonal rainfall probability for three areas in in prep. Kenya. Kenya Soil Survey, Nairobi.
3. Dodson, R.G. 1953 Geology of the S.E. Machakos Area (with coloured map) report no. 25. Geological Survey of Kenya, Nairobi.
4. EAMD, 1973 Summary of rainfall in Kenya for 1971, Nairobi
5. Fairburn, W.A. 1966 Geology of the Fort Hall Area (with coloured map, scale 1:125,000). Report No. 73. Geological Survey of Kenya, Nairobi.
6. Muchena, F.N. 1974 - 1975 Detailed Soil Survey of Kampi ya Mawe Station (with map at scale 1:2500) Kenya Soil Survey, Nairobi.
7. Musuva, I.E.M. 1968 A preliminary Soil Survey of Katumani Agricultural Research Station (copy in files K.S.S.).
8. Survey of Kenya, 1970 National Atlas of Kenya, third ed. p. 28 - 29.
9. Woodhead, T 1968 Studies of potential evaporation in Kenya, Ministry of Natural Resources, Water Development Dept., Nairobi.
10. Woodhead, T, 1970 The water balance as a guide to site potential, Journal Appl. Ecol. 7, p. 647 - 652.

Attached

Preliminary Soil Maps of :

1. Katumani Research Station
2. Murinduko Agricultural sub-station.
3. Embu Research Station (Block A)
4. Embu Research Station (Block B)

LABORATORY DATA SHEET.

Survey area/district/location: Masaku District Katumani Research Station

Field reference	162/1-3						
Horizon	A	B21	B2				
Depth in cm	0-15	15-55	55-115				
Laboratory number	10100	10101	10102				
Gravel %							
Texture class	SC	C	C				
% sand 2.0 - 0.05mm	51	39	39				
% silt 2 - 50 μ	6	8	20				
% clay 0 - 2 μ	43	41	41				
Soil liquid 1:1 susp.:							
pH-H ₂ O	6.0	5.8	8.0				
EC-H ₂ O in mmho's/cm, 25°C	0.19	0.16	0.35				
pH_KCl	4.9	5.0	6.8				
CaCO ₃ %	-	-	+				
CaSO ₄ ·2H ₂ O %							
C %	1.12						
N %	0.10						
C/N							
Cation exch. cap, pH 8.2 in me%	13.0	15.4	15.2				
" " " " 7.0							
Exchangeable Ca me%	5.0	7.2	12.4				
" Mg "	1.8	2.7	2.7				
" K "	2.0	0.8	0.8				
" Na "	0.1	0.3	0.2				
Base saturation %	68.5	71.4	-				
Exchangeable Al (Eq) "	0	0	0				
Clay minerals							
Montmorillonite group							poorly crystallized
Illite			x				} as main components
Kaolinite group/meta hallo- wysite			x				
Amorphous minerals							
SiO ₂ /Al ₂ O ₃							
SiO ₂ /Al ₂ O ₃							
Available P in ppm	15						
Permanent charge. me%							

7. APPENDIX:

Representative profile description for most of Katumani Research Station. Pt. No. 162/1-3. Soil classification: FERRAL - chromic LUVISOL .

Geological formation: quartzo-felspathic gneisses of Basement System.

Local petrography: -do-

Physiography: uplands

Relief-macro: gently undulating to undulating

Vegetation/land use: cultivated

Erosion: slight, sheet

Surface stoniness: nil

Slope gradient: 3%

Salinity/alkalinity: nil

Surface sealing: thin, moderate

Internal drainage class: well drained

- A 0 - 15cm Dark reddish brown (2.5YR 3/4 moist); clay; weak, fine to medium sub-angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few, very fine to fine pores; few fine roots; few micas
- B₁ 15-55cm Dark reddish brown (2.5YR 3/4 moist); clay; ^{massive to} weak, fine to medium sub-angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; patchy, thin clay cutans; few, very fine to fine pores; few micas
- B₂ 55-115cm+ Dark reddish brown (2.5YR 3/4, moist) clay, massive to weak, coarse, angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common, weak to moderate clay cutans; few, very fine to fine pores; patchy CaCO₃ powdery pockets, few micas

LABORATORY DATA SHEET.

Survey area/district/location: Embu district, Embu Experimental station

Field reference	135/2 - 6	a	b	c				
Horizon		A1	B21	B22				
Depth in cm		0-28	28-56	56-112				
Laboratory number		8174	10109	8175				
Gravel %			-					
Texture class		c	c	c				
% sand 2.0 - 0.05 mm		5	3	5				
% silt 2- 50 μ		12	16	10				
% clay 0 - 2 μ		73	81	85				
Soil liquid 1:1 susp.:								
pH-H ₂ O		6.3	6.6	6.6				
EC-H ₂ O in mmho's/cm, 25°C		0.15	0.16	0.09				
pH-KCl		5.3	5.6	6.2				
CaCO ₃ %								
CaSO ₄ · 2H ₂ O %								
C %		2.18	0.67	0.55				
N %		0.28	0.10	0.08				
C/N								
Cation exch. cap, pH 8.2 in me%		22.4	18.8	18.6				
" " " " 7.0 "								
Exchangeable Ca	"	11.2	10.6	11.3				
" Mg	"	2.4	2.8	2.4				
" K	"	1.88	1.80	1.75				
" Na	"	0.50	0.30	0.40				
Base saturation %		71.6	82.4	79.8				
Exchangeable Al (Hp)	"	0	0	0				
Clay minerals								
Montmorillonite group								
Illite								
Kaolinite group		100%	100%	100%				
Amorphous minerals								
SiO ₂ /Al ₂ O ₃								
SiO ₂ /R ₂ O ₃								
Available P in ppm		9						
Permanent charge. me%								

Representative profile description for Embu Research Station.
Pit No. 135/2-6

Soil classification: eutric Nitosol
Geological formation: Mount Kenya Phonolite (Kenyte)
Local petrography: -do-
Physiography: volcanic uplands
Relief-macro: undulating
Vegetation/land use: pasture
Erosion: nil
Surface stoniness: nil
Slope gradient: 2%
Salinity/alkalinity: nil
Surface sealing: nil
Internal drainage class: well drained

A 0 - 28 cm Dark reddish brown (5YR 3/2 moist); clay; crumbly to weak, moderate, sub-angular blocky structure; hard when dry friable when moist, sticky and plastic when wet; common, fine pores, few fine roots.

B₂₁ 28-56cm Dark reddish brown (2.5YR 2.5/4 moist); clay; porous massive to weak, moderate subangular structure; slightly hard when dry friable when moist, sticky and plastic when wet; common, very fine to fine pores.

B₂ 56-112⁺cm Dark reddish brown (2.5YR 3/4 moist); clay; weak, fine to medium, sub-angular blocky structure; soft when dry, friable when moist, sticky and plastic when wet; common, weak to moderate clay cutans; few, very fine to fine pores.

LABORATORY DATA SHEET

Survey area/district/location: Embu District - Murinduko

Field reference	135/2 - 2	a	b	B ₂₁	B ₂₂	B ₂₃
Horizon		A1	B22			
Depth in cm		0-30	49-110	30-50	50-80	80-120
Laboratory number		8172	8173			
Gravel %						
Texture class		C	C			
% sand 2.0 - 0.05 mm		12	12			
% silt 2 - 50 μ		15	7	12	12	10
% clay 0 - 2 μ		73	81	12	8	6
Soil liquid 1:1 susp.:		72		76	80	84
pH-H ₂ O		5.6	4.9			
EC-H ₂ O in mmho's/cm, 25°C		5.25		5.26	5.66	5.12
pH-KCl		4.6	4.0			
CaCO ₃ %		4.49		4.44	4.86	4.21
CaSO ₄ 2H ₂ O %						
C %		1.6	0.7	1.12	0.72	0.64
N %		0.15	0.07			
C/N		0.16		0.12	0.09	0.09
Cation exch. cap, pH 8.2 in me%		20.2	16.7	9	8	8
" " " " 7.0 " "						
Exchangeable Ca		6.0	3.2	17.99	14.12	12.0
" Mg		2.4	2.1	2.28	0.05	1.04
" K		1.13	0.25	2.25	0.02	0.50
" Na		0.50	0.35	2.19	0.02	0.20
Base saturation %		51.1	34.7	1.01	0.05	0.09
Exchangeable Al (Hp)		0.3	0.5	29	40	25
Clay minerals				0.10	<0.01	0.49
Montmorillonite group						
Illite		10%	10%			
Kaolinite group		90%	90%			
Amorphous minerals						
SiO ₂ /Al ₂ O ₃						
SiO ₂ /R ₂ O ₃						
Available P in ppm		7				
Permanent charge. me%						

16.9 | 17.2 | CEC clay 16.3 | 17.8 | 14.1 | 11.4
 (5x0.7 for 2C) ↑
 14x

Representative profile description for no. t of Murinduko Research
Station pit no. 135/2-2

Soil classification: rhodic FERRALSOL

Ustoxic Dystryperts.

Geological formation: Mount Kenya Phonolites (Kenytes)

Local petrography: -do-

Physiography: volcanic uplands

Relief-macro: very gently undulating

Vegetation/land use: cultivated

Erosion: nil

Surface stoniness: nil

Slope gradient: 1%

Salinity/alkalinity: nil

Surface sealing: nil

Internal drainage class: well drained

A 0-30cm Dark reddish brown (5YR 3/2 moist); clay; porous massive to weak sub-angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; few, very coarse and common, very fine to fine pores; many fine rocks.

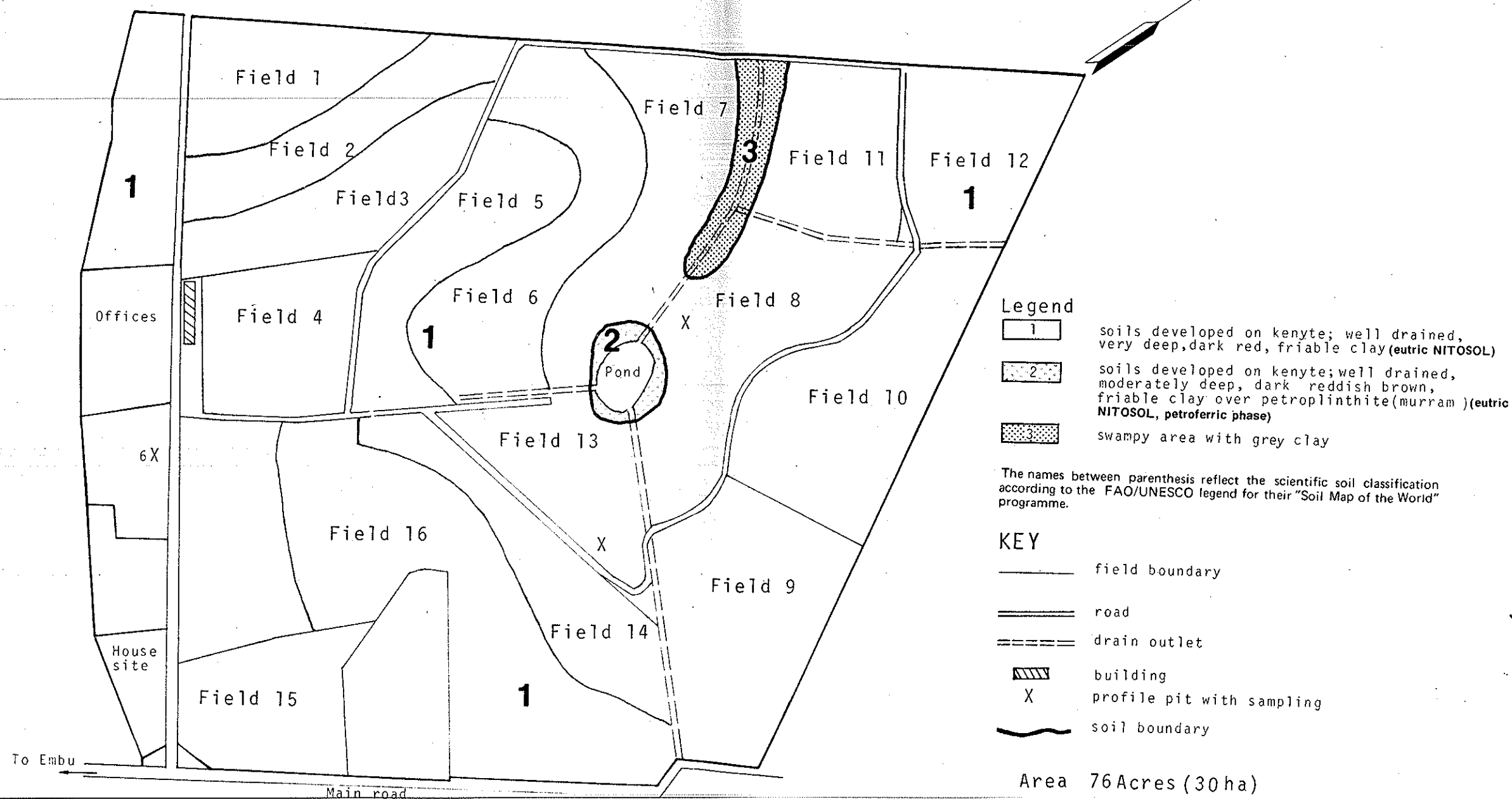
← B₂₁ 30-49cm Dark reddish brown (2.5YR 2.5/4 moist); clay; porous massive to weak, moderate, sub-angular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; common, very fine to fine pores.

B₂₂ 49-110cm+ Dark reddish brown (2.5YR 3/4 moist); clay; porous massive to weak sub-angular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many fine pores.

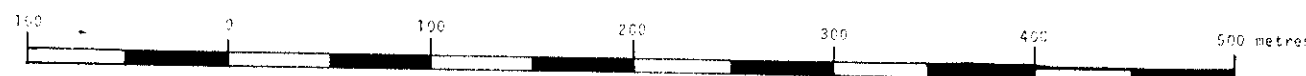
Remark: No clay cutans
Soil slightly magnetic

non-eroded:

SOILS OF EMBU RESEARCH STATION (BLOCK A)

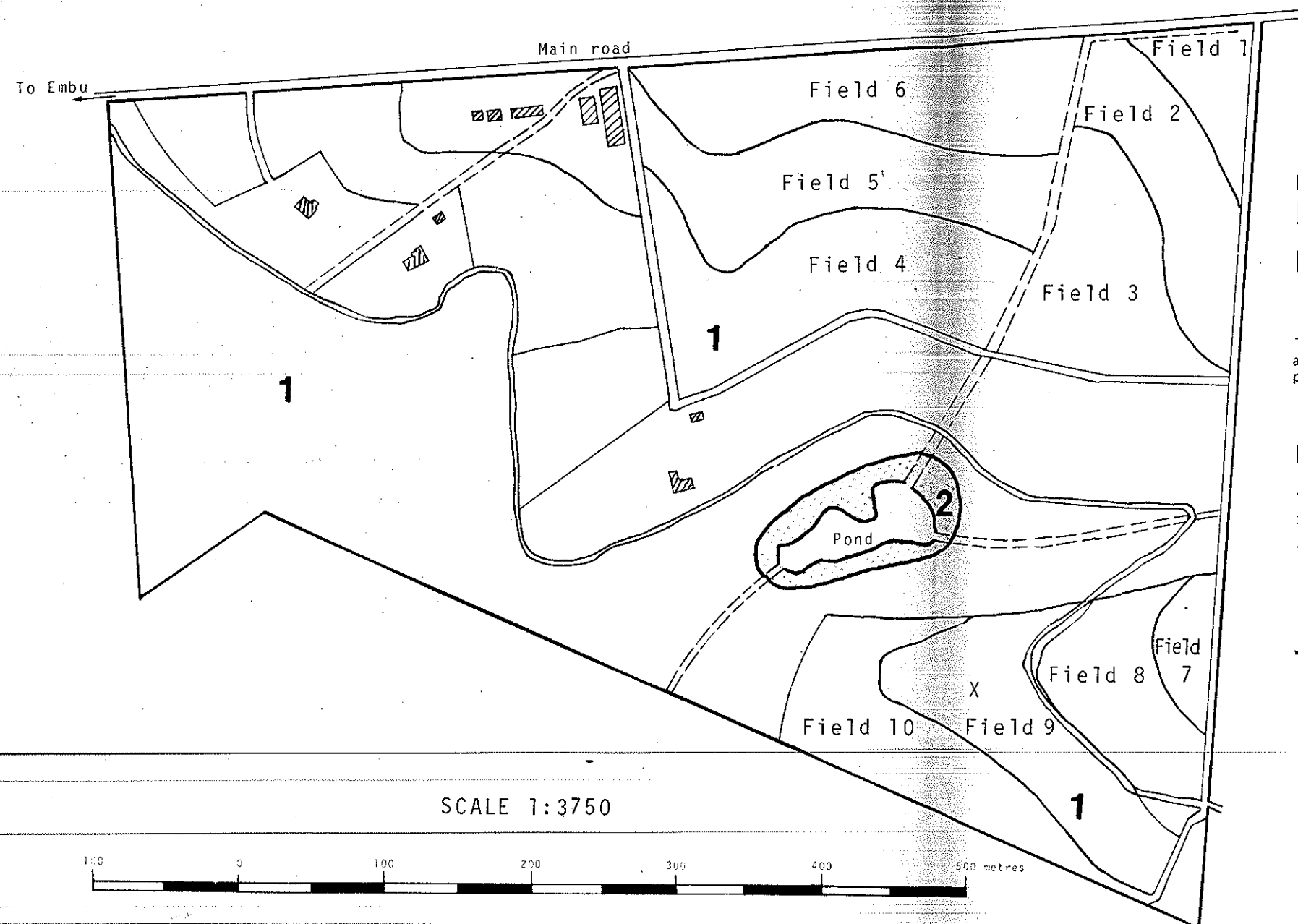


SCALE 1:3750



Base map retraced by K.S.S., December, 1974
Drawing No. 74027A

SOILS OF EMBU RESEARCH STATION (BLOCK B)



Legend

- 1 soils developed on kenyte; well drained, very deep, dark red, friable clay (eutric NITOSOL)
- 2 soils developed on kenyte; well drained, moderately deep, dark reddish brown, friable clay over petroplinthite (murram) (eutric NITOSOL, petroferic phase)

The names between parenthesis reflect the scientific soil classification according to the FAO/UNESCO legend for their "Soil Map of the World" programme.

KEY

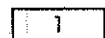
- field boundary
- road
- drain outlet
- building
- X profile pit with sampling
- soil boundary

Area 98 Acres (39ha)

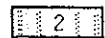
Base map retraced by K. S.S., December, 1974
Drawing No. 74028A

SOILS OF KATUMANI RESEARCH STATION

Legend



soils developed on precambrian Basement System rocks; well drained, moderately deep to deep, (if slopes are steeper than 8°, soils are shallow), dark red to dark reddish brown, friable to firm clay (FERRAL*
-chromic Luvisol)



like Unit 1, but reddish brown and predominantly very shallow (FERRAL*
-chromic Luvisol, lithic phase)



soils developed on Basement System rocks; imperfectly drained, deep, black, firm, cracking, moderately calcareous clay (pellic VERTISOL)

The names between parenthesis reflect the scientific soil classification according to the FAO/UNESCO legend for their "Soil Map of the World" programme; prefixes marked with * are tentative terms, awaiting international agreement on nomenclature for intergrading soil units.

KEY

— main road

- - - farm road



building

~ stream



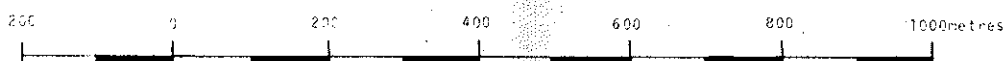
profile pit with sampling

— soil boundary

— station boundary

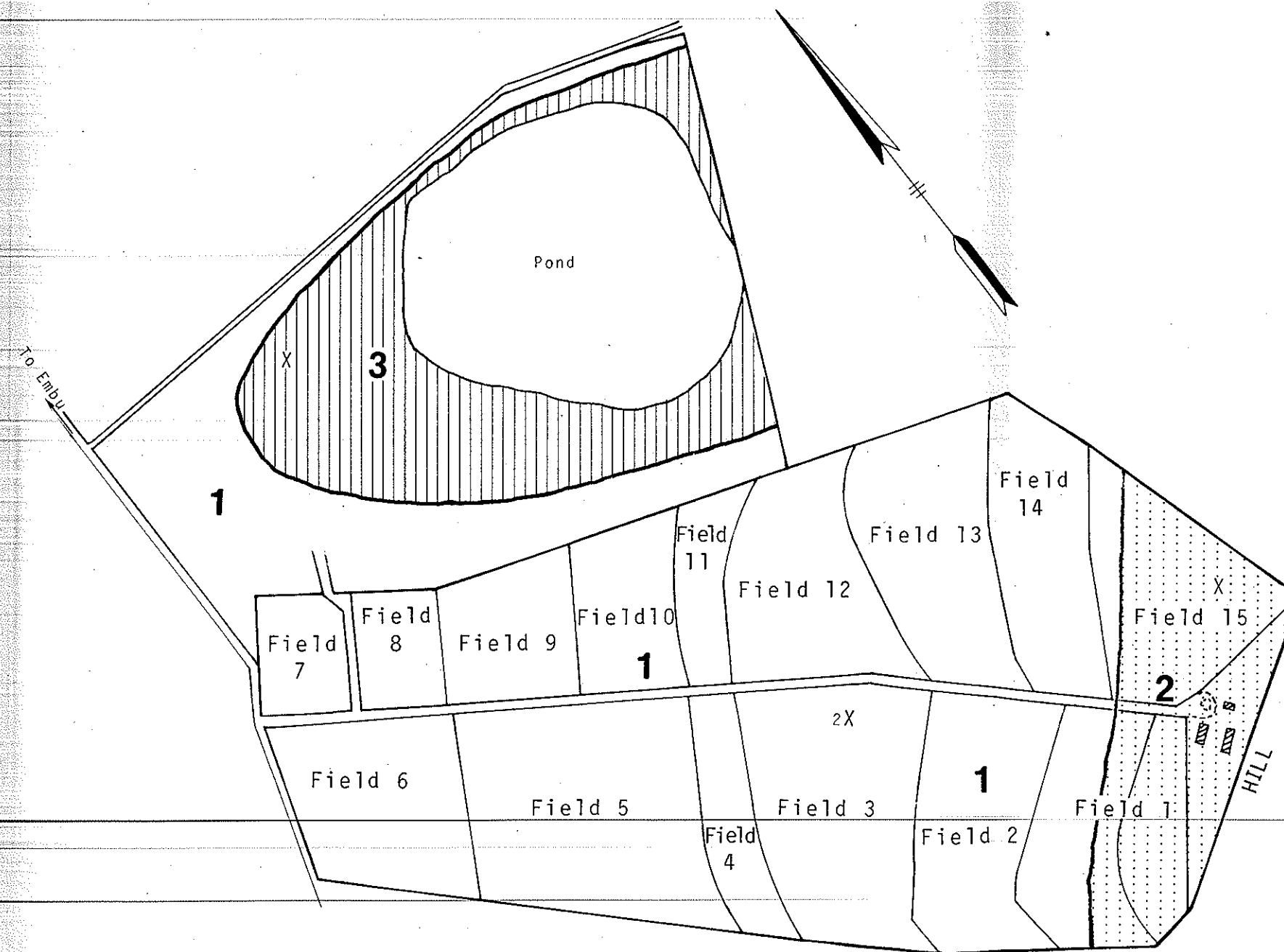
Area 684 Acres (273 ha)

SCALE 1:10000



Base map retraced by K.S.S., December, 1974
Drawing No. 74034A

SOILS OF MURINDUKO AGRICULTURAL SUB-STATION



Legend

- 1 soils developed on kenyte; well drained, deep, dark red, very friable, clay (rhodic FERRALSOL)
- ::2:: like Unit 1; but with sandy clay topsoil (rhodic FERRALSOL)
- ||3|| soils developed on kenyte; well drained, deep, dark reddish brown, friable clay (orthic FERRALSOL)

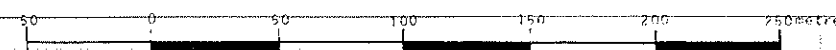
The names between parenthesis reflect the scientific soil classification according to the FAO/UNESCO legend for their "Soil Map of the World" programme.

KEY

- road
- field boundary
- building
- X profile pit with sampling
- soil boundary

Area 46 Acres (18ha)

SCALE 1:3000



Basemap retraced by K.S.S., December, 1974
Drawing No. 74029A