REPUBLIC OF KENYA

MINISTRY OF AGRICULTURE—NATIONAL AGRICULTURAL LABORATORIES

KENYA SOIL SURVEY

SOILS OF THE PROPOSED BURA EAST IRRIGATION SETTLEMENT SCHEME

by

F. N. Muchena and B. J. A. van der Pouw (editors)

VOLUME II– APPENDIX I

RECONNAISSANCE SOIL SURVEY REPORT No. R9a, 1981

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JULY, 1981

Appendix 1. Detailed descriptions and laboratory data of representative soil profiles

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Profile description no. 1

Observation/date	: 155-53, Garissa District, Bura East Project/16-3-79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 1.1
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: About 0.5%
Vegetation	: Acacia reficiens, Dobera glabra, Sporobolus ioclados, Schoenefeldia transiens; bushed grassland
Salinity/sodicity	: Strongly saline from 32cm; strongly sodic throughout
Surface sealing	: Strong, 2mm thick
Drainage class	: Imperfectly drained

A 0-17cm — Dark brown (10YR 3/4 dry; 10YR 3/3 moist); sandy clay loam; moderate, coarse to very coarse, columnar; very hard when dry, firm when moist, slightly sticky and slightly plastic when wet; few fine pores; few fine roots; pH-H_2O = 7.6; clear and wavy transition to:

(sample no. 155-53a)

Bt 17-32cm — Dark brown to brown (10YR 4/3 dry/moist); sandy clay loam; weak to moderate, medium, prismatic structure; very hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; moderately calcareous; many very fine pores; many very fine and fine roots; pH-H_2O = 8.4; clear and wavy transition to:

(sample no. 155-53b)

Btz 32-78cm — Greyish brown (10YR 5/1 dry; 10YR 5/2 moist); sandy clay; weak, medium angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; many salt crystals; common very fine pores; common very fine roots; pH-H_2O = 8.0; gradual and smooth transition to:

(sample no. 155-53c)

Btzk 78-105cm — Greyish brown (10YR 5/2 dry/moist); sandy clay; weak, medium angular and subangular blocky structure; slightly hard when dry, firm when moist, sticky and plastic when wet; continuous, thick clayskins; strongly calcareous; many salt crystals and pockets of soft powdery lime; common very fine, few fine pores; few very fine roots; pH-H_2O = 7.8; gradual and smooth transition to:

(sample no. 155-53d)

BCzk 105-160cm

Greyish brown (10YR 5/2 dry/moist); sandy clay; massive; slightly hard when dry, friable to firm when moist, sticky and plastic when wet; strongly calcareous; many salt crystals and pockets of soft powdery lime; common very fine, few fine pores; few very fine roots; pH-H_2O = 8.0

(sample no. 155-53e)

Note: The top and sides of the columnar elements are somewhat bleached.

LABORATORY DATA OF PROFILE DESCRIPTION No: 1

IELD OBSERVATION No: 155-53 MAPPING UNIT: Ps 1.1 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	5003	5004	5005	5006	5007	
Horizon	A	Bt	Btz	Btzk	BCzk	
Depth (cm)	0-17	17-32	32-78	78-105	105-160	
pH–H_2O (1: 2½ v/v)	7.6	9.5	8.6	8.5	8.4	
pH–KCl ..	6.2	7.7	7.7	7.9	7.7	
EC(mmho/cm) ..	0.65	0.55	6.5	6.5	6.0	
$CaCO_3$ (%)	tr	1.3	2.3	-	-	
$CaSO_4$ (%)	tr	tr	tr	tr	1.2	
C (%)	0.24	0.41	0.24	0.12	0.09	
N (%)						
C/N						
CEC (me/100g), pH 8.2	18.8	14.8	17.6	21.3	23.4	
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	17.9	16.7	69.5	46.5	51.7	
.. Mg ..	1.3	2.1	1.1	1.8	1.9	
.. K ..	1.0	0.2	0.5	0.7	0.5	
.. Na ..	3.3	2.2	5.8	14.6	15.6	
Sum of cations	24	21	77	64	70	
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	
.. .. %, pH 7.0						
ESP at pH 8.2	18	15	33	68	66	
Saturation extract:						
Moisture %			53	44	52	
pH–paste			7.5	7.6	7.4	
ECe (mmho/cm)			24.0	21.0	23.5	
Na(me/l)			-	159	176	
K ..			0.60	0.26	0.26	
Ca ..			-	34.0	33.0	
Mg ..			-	18.2	25.4	
Sum of cations(me/l)			-	211	235	
CO_3 (me/l)			-	0	0	
HCO_3 ..			-	26.0	27.0	
Cl ..			-	70.0	196	
SO_4 ..			-	14.1	11.3	
Sum of anions(me/l)			-	110	234	
SAR			-	31	33	
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X–ray report: A and Bt horizons: Predominantly well crystallized montmorillonite.

Depth (cm)	0-17	17-32	32-78	78-105	105-160	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	68	64	52	52	50	
Silt % 0.05–0.002mm	8	6	8	8	8	
Clay % 0.002–0 mm	24	30	40	40	42	
Texture class	SCL	SCL	SC	SC	SC	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–20cm) Laboratory no. 4858 /79

			Available	Total
pH–H_2O (1:2½ v/v)	8.0		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	4.30	
C%	0.38	K ..	0.36	
N%	-	Ca ..	10.0	
P–Olsen (ppm)		Mg ..	7.3	
		Mn ..	0.76	
		P (ppm)	18	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 2

Observation/date	: 155-67, Garissa District, Bura East Project/14-9-79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 1.1
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: About 0.5%
Vegetation	: Terminalia parvula, Grewia tenax, Maytenus sp., Sporobolus ioclades; bushed grassland
Salinity/sodicity	: Strongly saline from 5cm; strongly sodic throughout
Surface sealing	: Weak sealing
Drainage class	: Imperfectly drained

	0-5cm	Crust, hard when dry (sample no. 155-67a)
Bk	5-20cm	Dark brown (10YR 4/3 dry; 10YR 3/3 moist); sandy clay; weak, coarse columnar breaking to weak, medium subangular blocky structure; hard when dry, firm when moist; about 1% powdery lime; many very fine and fine pores; few very fine roots; pH-H_2O = 7.0, clear and wavy transition to: (sample no. 155-67b)
Bt	20-56cm	Very dark greyish brown (10YR 3/1 dry; 10YR 3/2 moist) sandy clay; weak, fine to medium, subangular blocky structure; hard when dry, firm when moist; patchy, thin clayskins; strongly calcareous; common very fine pores; common very fine roots (some dead); pH-H_2O = 7.5; gradual and smooth transition to: (sample no. 155-67c)
Btz	56-88cm	Very dark greyish brown (10YR 3/1 dry, 10YR 3/2 moist); clay; weak, medium to coarse angular blocky structure; hard when dry, firm when moist; broken, thin clayskins; strongly calcareous; many salt crystals; few, very fine to medium pores; few, very fine roots; pH-H_2O = 7.3; gradual and smooth transition to: (sample no. 155-67d)
Bc	88-133cm	Dark grey (10YR 4/1 dry/moist); clay; weak, medium subangular blocky structure; hard when dry; strongly calcareous; common very fine and fine pores; pH-H_2O = 7.3 (sample no. 155-67e)
C1	133-175cm	Grey (10YR 5/1 moist); clay; strongly calcareous; pH-H_2O = 7.5

C2	175-224cm	Grey (10YR 5/1 moist); gravelly clay; moderately calcareous; pH-H_2O = 7.5 (sample no. 155-67f)
C3	224-269cm	Grey to light grey (10YR 6/1 moist); gravelly clay; moderately calcareous; pH-H_2O = 7.5 (sample no. 155-67g)
C4	269-311cm	Grey (10YR 5/1 moist); gravelly sandy clay; slightly calcareous, pH-H_2O = 7.8 (sample no. 155-67h)
C5	311-360cm	Grey (10YR 5/1 moist); gravelly clay; slightly calcareous; pH-H_2O = 7.6 (sample no. 155-67k)
C6	360-388cm	Grey (10YR 5/1 moist); gravelly sandy clay; non calcareous; pH-H_2O = 7.2 (sample no. 155-671)

Note: The profile was augered from 133cm.

LABORATORY DATA OF PROFILE DESCRIPTION No: 2

LDOBSERVATION No: 155-67 MAPPING UNIT: Ps 1.1 SOIL CLASSIFICATION: orthic SOLONETZ

aboratory no. ...../79	10247	10248	10249	10250	10251	13004
orizon		Bk	Bt	Btn	BC	C2
epth (cm)	0-5	5-20	20-56	56-88	88-133	175-224
H-H_2O(1: 2½ v/v)	8.5	8.5	8.4	8.3	8.4	7.5
H-KCl ,,	6.9	7.6	7.7	7.7	7.6	
C(mmho/cm) ,,	0.5	4.0	5.5	6.5	4.5	>10
aCO_3(%)	-	-	-	-	-	2.1
aSO_4(%)	tr	tr	tr	0.1	0.1	-
(%)	0.26	0.29	0.23	0.20	0.12	-
(%)						
/N						
EC (me/100g), pH 8.2	36.4	31.2	38.0	38.0	31.2	39.8
EC ,, ,, pH 7.0						
xch.Ca (me/100g)	27.0	38.5	34.0	24.0	24.0	22.2
,, Mg ,,	10.6	5.5	7.0	2.4	2.1	-
,, K ,,	0.3	0.2	0.2	0.2	tr	0.9
,, Na ,,	4.3	8.5	10.1	13.5	15.0	20.3
um of cations						
ase sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
,, ,, %, pH 7.0						
SP at pH 8.2	12	22	30	36	48	51
Saturation extract:						
oisture %	26	65	50	58	72	65
-paste	8.1	7.7	7.7	7.8	7.5	7.3
Ce (mmho/cm)	2.25	17.0	23.0	20.0	21.5	12.5
a (me/l)	18.3	126	143	125	145	68.0
,,	0.14	0.61	0.48	0.36	0.40	0.58
a ,,	2.0	21.6	36.6	36.3	34.6	36.0
g ,,	1.4	22.6	50.1	36.6	35.7	19.6
um of cations(me/l)	21.8	171	230	198	216	124
O_3(me/l)	0	0	0	0	0	0
CO_3 ,,	7.0	9.0	10.0	10.0	10.0	5.90
,,	15.2	160	212	180	195	112
4 ,,	0.30	1.3	8.0	11.0	9.0	6.96
m of anions(me/l)	22.5	170	230	201	214	125
SAR	14	27	22	21	24	13
Clay mineralogy:						
O_2/Al_2O_3(mol/mol)						
O_2/R_2O_3 ,,						
$_2O_3$(mmol%)						
-ray report:						

Depth (cm)	0-5	5-20	20-56	56-88	88-133	175-224
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	76	52	50	54	40	44
Silt % 0.05-0.002mm	4	4	4	2	4	8
Clay % 0.002-0 mm	20	44	46	44	56	48
Texture class	SCL/SL	SC	SC	SC	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0- cm)		Laboratory no. /		
pH-H_2O (1: 2½ v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ,,		
N%		Ca ,,		
P-Olsen (ppm)		Mg ,,		
		Mn ,,		
		P (ppm)		

Various:

Remarks: The pH 1:2.5 and EC 1:2.5 values for the horizons below 175cm are field values.

Kenya Soil Survey
Drawing No. 79050

1-7

LABORATORY DATA OF PROFILE DESCRIPTION No:2 Continued.

FIELD OBSERVATION No: 155-67 MAPPING UNIT: Ps 1.1 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../	13005	13006	13007	13008		
Horizon	C3	C4	C5	C6		
Depth (cm)	224-269	269-311	311-360	360-388		
pH-H_2O(1: 2½ v/v)	7.5	7.8	7.6	7.2		
pH-KCl ,,						
EC(mmho/cm) ,,	>10	8.6	7.8	>10		
$CaCO_3$(%)	3.6	0.4	2.1	0.9		
$CaSO_4$(%)	-	-	-	-		
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	41.4	39.8	38.2	36.6		
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	14.9	14.7	12.5	14.7		
,, Mg ,,						
,, K ,,	0.2	0.2	0.2	0.2		
,, Na ,,	20.3	20.2	17.5	19.2		
Sum of cations						
Base sat. %, pH 8.2						
,, ,, %, pH 7.0						
ESP at pH 8.2	49	51	46	52		
Saturation extract:						
Moisture %	71	74	82	74		
pH-paste	7.5	7.7	7.7	7.8		
ECe (mmho/cm)	9.0	7.0	15.0	13.0		
Na(me/l)	31.0	30.8	101	-		
K ,,	0.41	0.21	0.26	-		
Ca ,,	38.5	24.8	30.0	31.5		
Mg ,,	20.0	13.1	16.3	25.4		
Sum of cations(me/l)	89.9	68.9	148	-		
CO_3(me/l)	0	0	0	0		
HCO_3 ,,	6.67	5.90	6.67	6.67		
Cl ,,	74.0	57.8	133	114		
SO_4 ,,	9.76	6.96	11.68	12.2		
Sum of anions(me/l)	90.4	70.1	152	133		
SAR	6	7	21	-		
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	224-269	269-311	311-360	360-388		
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	44	48	44	52		
Silt % 0.05-0.002mm	2	6	6	2		
Clay % 0.002-0 mm	54	46	50	46		
Texture class	C	SC	C	SC		
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25 mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0- cm)		Laboratory no. /		
pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ,,		
N%		Ca ,,		
P-Olsen (ppm)		Mg ,,		
		Mn ,,		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No 78050

Profile description no. 3

Observation /date	: 155/98; Garissa district (Bura East project area) 13-9-79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 1.2
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Sporobolus ioclados, Schoenefeldia transiens, Acacia reficiens, Maytenus sp, Grewia tenax; bushland
Salinity/sodicity	: Strongly saline and strongly sodic from 12cm
Surface sealing	: 1-3mm thick; strong
Drainage class	: Imperfectly drained

AB 0-12cm Very dark greyish brown (10YR 4/2 dry, 10YR 3/2 moist); sandy clay loam; weak, medium, columnar breaking into moderate, fine to medium, subangular blocky structure; hard when dry, firm when moist, slightly sticky and slightly plastic when wet; non-calcareous; common very fine pores; many, very fine and fine, and few medium roots; $pH\text{-}H_2O = 7.2$; clear and smooth transition to:

(sample no. 155-98a)

Bt1 12-30cm Dark brown to brown (10YR 4/3 moist); sandy clay; moderate, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; broken, moderately thick clay cutans; calcareous; many very fine and fine, common medium pores; very few, fine (dead) roots; $pH\text{-}H_2O = 7.6$; clear and wavy transition to:

(sample no. 155-98b)

Bt2 30-70cm Dark grey (10YR 4/1 moist); sandy clay; weak, medium angular blocky structure; friable when moist, sticky and plastic when wet; broken, thin clay cutans; strongly calcareous, few very fine and common fine pores; very few, very fine (dead) roots; $pH\text{-}H_2O = 7.7$; gradual and smooth transition to:

(sample no. 155-98c)

Bt3 70-126cm	Grey (10YR 5/1 moist); clay; weak, medium to coarse, angular blocky structure; friable when moist, sticky and plastic when wet; patchy, thin clay cutans; strongly calcareous; many, very fine and fine pores; very few, very fine dead roots; pH-H_2O = 7.6; diffuse and smooth transition to: (sample no. 155-98d)
BC 126-185cm	Dark greyish brown (10YR 4/2 moist); clay; massive; friable when moist, sticky and plastic when wet; no cutans; strongly calcareous; very few, very fine pores; no roots; pH-H_2O = 7.8; (sample nos. 155-98e and f)
C1 185-281cm	Grey to light grey (10YR 6/1 moist); clay; friable when moist, sticky and plastic when wet; strongly calcareous; pH-H_2O = 7.8; (sample nos. 155-98g and h)
Cy1 281-335cm	Light grey (10YR 7/1 moist); clay; sticky and plastic when wet; slightly calcareous; 3% gypsum crystals; pH-H_2O=7.8; (sample no. 155-98j)
Cy2 335-373cm	Grey to light grey (10YR 6/1 moist); clay; sticky and plastic when wet; slightly calcareous; 5% gypsum crystals and 2% calcium carbonate nodules; pH-H_2O = 7.4; (sample no. 155-98k)
Cy3 373-413cm	like above, but pH-H_2O = 7.0; 20% gypsum crystals and 1-2% calcium carbonate nodules (sample no. 155-98l)
Cy4 413-445cm	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; slightly calcareous; 40% gypsum crystals; pH-H_2O = 7.3 (sample no. 155-98m)

Note: The profile was augered from 185cm.

LABORATORY DATA OF PROFILE DESCRIPTION No: 3

FIELD OBSERVATION No: 155-98 MAPPING UNIT: Ps 1.2 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ..... / 79	12988	12989	12990	12991	12992	12993
Horizon	AB	Bt1	Bt2	Bt3	BC	BC
Depth (cm)	0-12	12-30	30-70	70-126	126-145	145-185
pH-H_2O(1: 2½ v/v)	8.0	8.2	8.1	8.1	8.3	8.5
pH-KCl ..						
EC(mmho/cm) ..	1.3	5.5	5.0	7.0	5.0	4.5
$CaCO_3$ (%)	0.6	0.7	0.6	2.1	2.1	4.2
$CaSO_4$ (%)	0.1	0.1	0.1	tr	tr	tr
C (%)						
N (%)						
C/N						
CEC (me/100g). pH 8.2	17.4	34.6	33.4	33.4	34.6	36.2
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	6.7	24.7	32.7	22.2	18.2	38.7
.. Mg ..						
.. K ..	0.4	0.3	0.5	0.5	0.4	0.5
.. Na ..	0.6	9.6	14.7	10.6	12.1	13.8
Sum of cations						
Base sat. %, pH 8.2	100+	100+	100+			
.. .. %, pH 7.0						
ESP at pH 8.2	3	28	44	32	35	38
Saturation extract:						
Moisture %	35	49	47	71	73	73
pH-paste	7.9	7.3	7.8	7.5	7.5	7.7
ECe (mmho/cm)	5.50	17.0	9.5	24.0	19.0	18.0
Na (me/l)	44.0	-	31.0	200	142	143
K ..	0.56	-	0.77	0.21	0.15	0.32
Ca ..	6.0	27.5	39.8	15.0	39.8	33.8
Mg ..	4.38	19.6	23.3	26.7	17.7	15.8
Sum of cations(me/l)	54.9	-	94.8	242	200	193
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ..	8.66	10.0	-	8.06	9.99	10.0
Cl ..	45.0	-	-	-	172	164
SO_4 ..	0.60	2.70	-	-	7.80	6.30
Sum of anions(me/l)	54.3	-	-	-	100	180
SAR	19	-	6	44	26	29
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report: AB, Bt1 and Bt2 horizons: Predominantly montmorillonite of good crystallization and traces of illite.

Depth (cm)	0-12	12-30	30-70	70-126	126-145	145-185
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	66	50	58	38	42	44
Silt % 0.05-0.002mm	4	6	6	8	10	8
Clay % 0.002-0 mm	30	44	36	54	46	48
Texture class	SCL	SC	SC	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30cm) Laboratory no. 12742/79

			Available	Total
pH-H_2O (1: 2½ v/v)	7.4		Available	Total
Exch.acidity (me/100g)	-	Na (me/100g)	3.66	
C%	0.56	K ..	0.44	
N%		Ca ..	4.3	
P-Olsen (ppm)		Mg ..	6.2	
		Mn ..	0.84	
		P (ppm)	8	

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 3 Continued

FIELD OBSERVATION No: 155-98 MAPPING UNIT: Pe 1.2 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ..... /79	12994	12995	12996	12997	12998	12999
Horizon	C1	C1	Cy1	Cy2	Cy3	Cy4
Depth (cm)	185-225	225-281	281-335	335-373	373-413	413-445
pH-H_2O(1:2½ v/v)	8.6	8.2	8.1	7.5	7.6	7.4
pH-KCl ..						
EC (mmho/cm) ..	4.5	7.0	5.5	9.5	7.0	5.5
$CaCO_3$(%)	3.9	3.2	4.6	2.1	2.2	2.2
$CaSO_4$(%)	tr	tr	tr	tr	tr	tr
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	43.0	38.2	39.8	33.4	28.6	35.0
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	10.6	20.2	21.2	23.7	18.2	14.7
.. Mg ..						
.. K ..	0.3	0.4	0.4	0.5	0.1	0.1
.. Na ..	12.6	9.6	14.8	11.8	12.1	11.6
Sum of cations						
Base sat. %, pH 8.2				100+	100+	
.. .. %, pH 7.0						
ESP at pH 8.2	29	25	37	35	42	33
Saturation extract:						
Moisture %	77	74	64	59	88	70
pH-paste	7.8	7.7	7.7	7.9	7.8	7.8
ECe (mmho/cm)	16.0	17.5	16.5	15.0	14.5	14.5
Na (me/l)	132	128	121	110	107	105
K ..	0.41	0.46	0.51	0.62	0.41	0.36
Ca ..	18.3	34.3	31.5	29.5	26.3	27.8
Mg ..	9.0	13.1	12.5	11.9	12.5	12.7
Sum of cations(me/l)	160	176	166	152	146	146
CO_3(me/l)	0	0	0	0	0	0
HCO_3 ..	9.33	10.6	8.66	10.0	9.99	9.33
Cl ..	149	158	149	141	125	125
SO_4 ..	2.30	6.09	7.30	8.80	9.40	11.9
Sum of anions(me/l)	161	175	165	160	144	146
SAR	36	26	26	24	24	23
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	185-225	225-281	281-335	335-373	373-413	413-445
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	44	44	48	62	50	50
Silt % 0.05-0.002mm	12	8	4	10	8	16
Clay % 0.002-0 mm	44	48	44	28	42	34
Texture class	C	C	SC	SCL	SC	SCL
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0- cm)		Laboratory no. /	Available	Total
pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen(ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 4

Observation/date	: 155-54, Garissa District, Bura East Project/16-3-79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 1.3
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: About 1%
Vegetation	: Grewia tenax, Acacia reficiens, Tetrapogon tenellus, Sporobolus ioclados; bushed grassland
Salinity/sodicity	: Strongly saline from 48cm; strongly sodic throughout
Surface sealing	: Strong sealing, 1cm thick
Drainage class	: Imperfectly drained

A 0-8cm Dark brown (10YR 4/3 dry, 10YR 3/3 moist); sandy clay loam; weak, fine to medium, subangular blocky structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; many very fine pores; many very fine roots; pH-H_2O = 8.2; abrupt and wavy transition to:

(sample no. 155-54a)

Bt 8-48cm Dark greyish brown (10YR 4/2 dry/moist); sandy clay loam; moderate, very coarse prismatic; very hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; common, very fine and fine pores; common, very fine and fine roots; pH-H_2O = 8.2; abrupt and smooth transition to:

(sample no. 155-54b)

Btk 48-70cm Dark brown to brown (10YR 4/3 moist); sandy clay; weak, fine to medium subangular blocky structure; firm when moist, slightly sticky and slightly plastic when wet; broken, thin clayskins; strongly calcareous; pockets of soft lime; common very fine pores; common very fine roots; pH-H_2O = 7.8; clear and smooth transition to:

(sample no. 155-54c)

Bck 70-100cm Brown (10YR 6/4 dry, 10YR 5/3 moist); sandy clay; massive; hard when dry, friable to firm when moist; strongly calcareous; pockets of soft lime; many very fine pores; common very fine roots; pH-H_2O = 7.8; gradual and smooth transition to:

(sample no. 155-54d)

Ck 100-150cm Brown (10YR 7/4 dry, 10YR 5/3 moist); sandy clay; massive; slightly hard when dry, friable to firm when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pockets of soft lime; many very fine pores; few very fine roots; pH-H_2O = 8.2

LABORATORY DATA OF PROFILE DESCRIPTION No: 4

ELD OBSERVATION No: 155-54 MAPPING UNIT: Ps 1.3

SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	5008	5009	5010	5011	5012	
Horizon	A	Bt	Btk	BCk	Ck	
Depth (cm)	0-8	8-48	48-70	70-100	100-150	
H-H_2O(1:2½ v/v)	8.6	9.0	8.4	8.6	8.6	
H-KCl ..	7.6	7.6	7.7	7.7	7.7	
C(mmho/cm) ..	0.50	1.2	6.0	5.0	4.5	
aCO_3(%)						
aSO_4(%)	tr	tr	tr	1.2	1.4	
(%)	0.44	0.18	0.30	0.27	0.09	
(%)						
/N						
C (me/100g), pH 8.2	20.4	17.2	19.6	20.9	20.0	
C .. .. pH 7.0						
ch.Ca (me/100g)	51.8	70.5	72.5	70.5	69.5	
Mg ..	0.5	0.7	0.9	1.4	1.1	
K ..	1.6	0.4	0.3	0.2	0.3	
Na ..	3.0	8.6	12.3	12.8	14.1	
of cations	57	80	86	85	85	
e sat. %, pH 8.2	100+	100+	100+	100+	100+	
" %, pH 7.0						
at pH 8.2	15	50	63	61	70	
uration extract:						
ture %		41	46	45	45	
aste		7.6	7.5	7.7	7.6	
(mmho/cm)		4.5	24.0	18.5	16.0	
e/l)			165	150	82	
..			0.13	0.13	0.26	
.			54.8	17.0	40.0	
.			20.2	17.4	37.0	
f cations(me/l)			240	185	159	
e/l)			0	0	0	
..			25.0	24.0	23.0	
..			202	156	134	
..			11.7	7.04	3.3	
anions(me/l)			239	187	160	
R			27	36	13	
mineralogy:						
$_2O_3$(mol/mol)						
O_3 ..						
mol%)						

port:

Depth (cm)	0-8	8-48	48-70	70-100	100-150	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	68	60	56	54	50	
Silt % 0.05–0.002mm	6	8	4	6	10	
Clay % 0.002–0 mm	26	32	40	40	40	
Texture class	SCl	SCl	SC	SC	SC	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
" " 1.0 – 0.50mm						
" " 0.50 – 0.25 mm						
" " 0.25 – 0.10mm						
" " 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–20 cm) Laboratory no. 4859 / 79

			Available	Total
pH-H_2O (1: 2½ v/v)	8.5			
Exch. acidity (me/100g)	-	Na (me/100g)	1.80	
C%	0.67	K ..	0.26	
N%		Ca ..	27.0	
P-Olsen (ppm)		Mg ..	3.1	
		Mn ..	0.02	
		P (ppm)	11	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 5

Observation	: 155-73; Garissa district; Bura East irrigation project;10/8/79
Soil classification	: luvic XEROSOL
Mapping unit	: Ps 2.1
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Bothriochloa glabra, Triumfetta flavescens, Heliotropium sp; dwarf shrub grassland
Salinity/sodicity	: Non-saline throughout; moderately sodic from 117cm
Surface sealing	: Nil
Drainage class	: Moderately well drained

A 0-9cm Dark brown (10YR 3/3 moist); clay; massive; friable when moist, sticky and plastic when wet; non-calcareous; few, very fine and fine pores; common very fine and fine and few medium roots; pH-H_2O = 7.3; gradual and smooth transition to:
(sample no. 155-73a)

Bt1 9-30cm Dark brown (10YR 4/3 dry; 10YR 3/3 moist); clay; moderate, very fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; patchy, thin clayskins and slickensides; non-calcareous; common very fine and fine pores; common very fine and fine and few large roots; pH-H_2O = 7.1; clear and smooth transition to:
(sample no. 155-73b)

Bt2 30-66cm Dark greyish brown (10YR 4/2 moist); clay; weak, coarse to very coarse prismatic with tendency to weak, medium to coarse, angular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; patchy thin clayskins; few, very fine, fine and medium roots; pH-H_2O = 7.8; clear and smooth transition to:
(sample no. 155-73c)

BC 66-117cm Dark grey (10YR 5/2 dry; 10YR 4/1 moist); clay; massive with tendency to weak, fine to medium, subangular blocky structure; soft when dry, very friable when moist, sticky and plastic when wet; common very fine and fine pores; pH-H_2O= 8.2; diffuse and smooth transition to:
(sample no. 155-73d)

C 117-210cm Grey to light grey (10YR 6/1 dry; 10YR 5/1 moist); clay; massive; soft when dry, friable when moist, sticky and plastic when wet; common, very fine and fine pores; pH-H_2O increases from 8.2 (117-150cm) to 9.6 (150-200cm).
(sample no. 155-73e and f)

LABORATORY DATA OF PROFILE DESCRIPTION No: 5

ELDOBSERVATION No: 155-73 MAPPING UNIT: Pm 2.1 SOIL CLASSIFICATION: luvic XEROSOL

Laboratory no. ..... /79	11663	11664	11665	11666	11667	11668
Horizon	A	Bt1	Bt2	BC	C	C
Depth (cm)	0-9	9-30	30-66	66-117	117-150	150-200
pH–H_2O (1:2½ v/v)	6.7	7.2	7.3	7.9	8.6	8.5
pH–KCl ..	5.4	4.9	5.9	6.6	6.9	6.7
EC (mmho/cm) ..	0.08	0.06	0.19	0.35	0.35	0.4
$CaCO_3$ (%)						
$CaSO_4$ (%)	tr	tr	tr	tr	tr	tr
C (%)	0.24	0.33	0.24	0.18	0.18	0.36
N (%)						
C/N						
CEC (me/100g), pH 8.2	30.4	33.2	33.2	36.4	44.0	42.8
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	6.4	6.4	8.5	14.4	14.4	16.3
.. Mg ..	8.2	10.4	13.0	14.0	12.6	12.4
.. K ..	2.8	3.4	4.1	4.5	3.6	3.9
.. Na ..	1.2	2.1	2.6	3.4	5.8	14.8
Sum of cations	19	22	29	38	36	47
Base sat. %, pH 8.2	61	67	88	100+	83	100+
.. .. %, pH 7.0						
ESP at pH 8.2	4	6	8	9	13	35
Saturation extract:						
Moisture %						
pH–paste						
ECe (mmho/cm)						
Na (me/l)						
K ..						
Ca ..						
Mg ..						
Sum of cations (me/l)						
CO_3 (me/l)						
HCO_3 ..						
Cl ..						
SO_4 ..						
Sum of anions (me/l)						
SAR						
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report: A, Bt1 and Bt2 horizons: Illite is predominant. It has a moderate crystallization in the A-horizon, but poor crystallization in the lower two horizons.

Depth (cm)	0-9	9-30	30-66	66-117	117-150	150-200
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	44	34	28	26	28	32
Silt % 0.05–0.002mm	6	6	4	4	16	22
Clay % 0.002–0 mm	50	60	68	60	56	46
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–20 cm) Laboratory no. 11678 /79

			Available	Total
pH–H_2O (1:2½ v/v)	6.3			
Exch. acidity (me/100g)	-	Na (me/100g)	0.35	
C%	0.55	K ..	1.77	
N%	-	Ca ..	8.2	
P–Olsen (ppm)		Mg ..	8.2	
		Mn ..	0.32	
		P (ppm)	4	

Various:

Remarks:

Profile description no. 6

Observation/date	: 141-8, Garissa district, Bura East project; 13-9-79
Soil classification	: luvic XEROSOL
Mapping unit	: Ps 2.2
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Acacia reficiens, Acacia mellifera, Grewia tenax, Chrysopogon aucheri, Bothriochloa glabra, Aristida keniensis, Dactyloctenium scindicum; bushed grassland
Salinity/sodicity	: Non-saline throughout; moderately to strongly sodic from 150cm
Surface sealing	: Nil
Drainage class	: Imperfectly drained

A 0-8cm Dark greyish brown (10YR 5/2 dry; 10YR 4/2 moist); sandy clay; porous massive with tendency to weak, very fine and fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many very fine, common fine and medium pores; many very fine, common fine and medium pores; many, very fine and fine roots; pH-H_2O = 8.1; clear and smooth transition to:
(sample no. 141-8a)

Bk 8-39cm Brown (10YR 5/3 moist); sandy clay; porous massive with tendency to weak, fine subangular blocky structure; friable when moist, sticky and plastic when wet; moderately calcareous; pockets of soft lime(15-10%); many very fine and fine and common medium pores; many, very fine and fine roots; pH-H_2O=8.3; gradual and smooth transition to:
(sample no. 141-8b)

Btl 39-85cm Dark greyish brown (10YR 4/2 moist); clay; weak, medium angular blocky structure; sticky and plastic when wet; broken, moderately thick clayskins; moderately calcareous; pockets of soft lime (1%); many very fine and fine and common medium pores; common, very fine and fine roots; pH-H_2O = 8.3; diffuse and smooth transition to:
(sample no. 141-8c)

Bt2	85-133cm	Grey to light grey (10YR 5/1 moist); clay; weak, medium to coarse angular blocky structure; sticky and plastic when wet; broken, moderately thick clayskins; slightly calcareous; many very fine and fine, common medium pores; few, very fine and fine roots; pH-H_2O = 8.5; diffuse and smooth transition to: (sample no. 141-8d)
Bt3	133-250cm	Greyish brown (10YR 5/2 moist); clay; porous massive with tendency to weak, very fine and fine angular blocky structure; sticky and plastic when wet; patchy, thin clay skins; slightly calcareous; many, very fine and fine pores; few, very fine and fine roots; pH-H_2O increases from 8.4 (133-150cm) to 8.7 (150-200cm) and 8.9 (200-250cm); (sample no. 141-8e, f and g)
Cl	250-285cm	Brown (10YR 5/3 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 9.2; (sample no. 141-8h)
Cl	285-355cm	Greyish brown (10YR 5/2 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 9.4. (sample nos. 141-8j and k)

Note: The profile was augered from 180cm.

LABORATORY DATA OF PROFILE DESCRIPTION No: 6

.D OBSERVATION No: 141-8 MAPPING UNIT: Pw 2.2 SOIL CLASSIFICATION: luvic XEROSOL

aboratory no. ...../79	12880	12881	12882	12883	12884	12885
orizon	A	Bk	Bt1	Bt2	Bt3	Bt3
epth (cm)	0–8	8–39	39–85	85–133	133–150	150–200
$H-H_2O$(1: 2½ v/v)	8.1	8.3	8.2	8.4	8.6	8.9
H–KCl ..						
C(mmho/cm) ..	0.55	0.45	0.40	0.40	0.45	0.45
aCO_3(%)	1.1	1.9	1.6	1.6	1.4	2.1
aSO_4(%)	0.2	0.1	tr	tr	tr	tr
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	25.0	23.8	30.5	-	31.8	33.1
EC .. .. pH 7.0						
xch.Ca (me/100g)	26.7	43.5	39.7	-	40.0	39.9
.. Mg ..	0.6	1.5	3.4	-	3.6	4.8
.. K ..	2.4	1.8	1.8	-	2.1	2.0
.. Na ..	0.2	0.3	0.6	-	2.0	4.5
um of cations	30	47	46	-	48	51
ase sat. %, pH 8.2	100+	100+	100+	-	100+	100+
.. .. %, pH 7.0						
SP at pH 8.2	1	1	2	-	6	14
Saturation extract:						
oisture %			58	62	73	75
H–paste			7.5	8.0	8.1	8.2
Ce (mmho/cm)			0.30	0.40	0.50	0.50
a (me/l)			1.78	2.76	3.95	5.00
..			0.28	0.18	0.23	0.28
a ..			1.50	1.00	0.75	0.75
g ..			0.4	0.63	0.63	0.42
um of cations(me/l)			4.0	4.6	5.6	5.5
O_3 (me/l)			0	0	0	0
HCO_3 ..			2.00	3.10	4.00	3.80
l ..			1.00	0.94	1.00	2.00
O_4 ..			0.94	0.94	0.94	0.94
um of anions(me/l)			3.9	5.0	5.9	6.7
SAR			2	3	5	7
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X–ray report: A and Bk horizons: Mainly amorphous material, with traces of illite.

Depth (cm)	0–8	8–39	39–85	85–133	133–150	150–200
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	56	48	42	38	36	36
Silt % 0.05–0.002mm	4	8	8	6	4	6
Clay % 0.002–0 mm	40	44	50	56	60	58
Texture class	SC	SC	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30 cm) Laboratory no. 12738/ 79

			Available	Total
pH–H_2O (1: 2½ v/v)	7.5			
Exch. acidity (me/100g)	-	Na (me/100g)	0.38	
C%	0.59	K ..	1.12	
N%	-	Ca ..	9.2	
P–Olsen (ppm)		Mg ..	5.9	
		Mn ..	0.50	
		P (ppm)	10	

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 6 Continued.

LDOBSERVATION No: 141-8 MAPPING UNIT: Ps 2.2 SOIL CLASSIFICATION: luvic XEROSOL

aboratory no. ...../79	12886	12887	12888	12889		
orizon	Bt3	C1	C2	C2		
epth (cm)	200–250	250–285	285–355	355–404		
H–H_2O(1:2½ v/v)	8.7	9.0	9.2	9.3		
H–KCl ..						
C(mmho/cm) ..	0.50	0.60	0.70	1.35		
aCO_3(%)	1.6	2.6	3.1	2.4		
aSO_4(%)	0.5	1.0	1.2	1.4		
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	33.4	34.6	43.0	49.8		
EC .. .. pH 7.0						
xch.Ca (me/100g)	31.2	14.7	14.7	6.0		
.. Mg ..						
.. K ..	0.8	0.9	0.7	0.5		
.. Na ..	9.6	17.6	13.1	24.4		
um of cations						
ase sat. %, pH 8.2	100+					
.. .. %, pH 7.0						
SP at pH 8.2	29	50	30	49		
Saturation extract:						
oisture %	90	123	73	85		
H–paste	8.1	8.4	7.7	8.1		
Ce (mmho/cm)	0.15	0.15	0.40	0.70		
a(me/l)	–	–	1.00	4.50		
..	–	–	0.23	0.25		
a ..	–	–	2.50	1.50		
g ..	–	–	0.40	0.63		
um of cations(me/l)	–	–	4.1	6.9		
O_3(me/l)	–	–	0	0		
CO_3 ..	–	–	3.60	5.10		
..	–	–	1.00	1.25		
$_4$ ..	–	–	–	0.94		
m of anions(me/l)	–	–	4.6	7.3		
SAR	–	–	1	4		
Clay mineralogy:						
O_2/Al_2O_3(mol/mol)						
O_2/R_2O_3 ..						
$_2O_3$(mmol%)						
-ray report:						

Depth (cm)	200–250	250–285	285–355	355–404		
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	32	34	36	38		
Silt % 0.05–0.002mm	8	10	8	6		
Clay % 0.002–0 mm	60	56	56	56		
Texture class	C	C	C	C		
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH–H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 7

Observation/date	: 141-9, Garissa district, Bura East project/14-9-79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.3
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Indigofera schimperi, Acacia reficiens, Sporobolus helvolus, Chrysopogon aucheri; bushed grassland
Salinity/sodicity	: Non-saline, but strongly sodic from 96cm
Surface sealing	: Nil
Drainage class	: Imperfectly drained

A 0-38cm Dark greyish brown (10YR 5/2 dry, 10YR 4/2 moist); clay; porous massive with tendency to weak, very fine to fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine and fine and few medium pores; many very fine and fine, few medium and very few coarse roots; pH-H_2O = 8.2; clear and smooth transition to:

(sample no. 141-9a)

Bw1 38-64cm Dark greyish brown (10YR 4/2 moist); clay; weak, medium to coarse, prismatic breaking to moderate, fine to medium, angular blocky structure; friable when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; many, very fine and fine pores; common, very fine and fine and few medium roots; pH-H_2O= 8.4; gradual and smooth transition to:

(sample no. 141-9b)

Bw2 64-96cm Dark grey (10YR 4/1 moist); clay; moderate, fine to medium, subangular blocky structure; friable when moist, sticky and plastic when wet; common, moderate pressure faces; strongly calcareous; common very fine and fine pores; common, very fine and fine roots; pH-H_2O = 8.7; gradual and smooth transition to:

(sample no. 141-9c)

Bw3 96-120cm Very dark greyish brown (10YR 3/2 moist); clay; weak, fine to medium, angular blocky structure; firm when moist, sticky and plastic when wet; patchy, thin clayskins; few, weak slickensides; strongly calcareous; common, very fine and fine pores; few, very fine roots (some dead); pH-H_2O = 9.4; clear and smooth transition to:

(sample no. 141-9d)

Bw4	120-196cm	Dark greyish brown (10YR 4/2 moist); distinct, fine and medium, grey mottles; clay; weak, fine to medium, angular blocky structure; few, weak slickensides; moderately calcareous; common, very fine and fine pores; few, very fine roots (some dead); pH-H_2O = 9.3 (sample nos. 141-9e and f)
BC1	196-241cm	Brown (10YR 5/3 moist); clay; moderately calcareous; pH-H_2O = 9.1 (sample no. 141-g)
BC2	241-269cm	Greyish brown (10YR 5/2 moist); clay; slightly calcareous; pH-H_2O = 9.1 (sample no. 141-9h)
Ck1	269-325cm	Light brownish grey (10YR 6/2 moist); gravelly clay; slightly calcareous; many calcium carbonate nodules; pH-H_2O = 9.2 (sample no. 141-9j)
Ck2	325-360cm	Light brownish grey (10YR 6/2 moist); clay; slightly calcareous; many calcium carbonate nodules; pH-H_2O = 8.5 (sample no. 141-9k)

Notes: 1) Sandy material from the topsoil has been washed down into the Bw4 horizon.
2) The profile was augered from 196cm.

LABORATORY DATA OF PROFILE DESCRIPTION No: 7

ELD OBSERVATION No: 141-9 MAPPING UNIT: Pe 2.3 SOIL CLASSIFICATION: haplic XEROSOL

aboratory no. ..... /79	12854	12855	12856	12857	12858	12859
orizon	A	Bt1	Bt2	Bt3	Bt4	Bt4
epth (cm)	0–38	38–64	64–96	96–120	120–150	150–196
H–H_2O (1: 2½ v/v)	8.2	8.3	8.9	9.3	9.5	9.7
H–KCl ..						
C (mmho/cm) ..	0.30	0.30	0.40	0.75	1.6	1.7
aCO_3 (%)	1.3	1.2	1.2	1.2	1.4	1.2
aSO_4 (%)	tr	tr	tr	tr	0.7	0.1
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	33.0	31.5	33.7	31.5	34.4	37.4
EC .. .. pH 7.0						
xch.Ca (me/100g)	54.7	41.7	40.0	39.5	13.6	11.5
.. Mg ..	4.1	5.6	6.2	5.6		
.. K ..	2.9	3.2	2.4	2.4	1.9	1.4
.. Na ..	0.4	0.8	2.4	10.8	16.9	23.1
um of cations	62	51	51	60		
ase sat. %, pH 8.2	100+	100+	100+	100+		
.. .. %, pH 7.0						
SP at pH 8.2	1	3	9	34	49	62
Saturation extract:						
oisture %	56	56	64	108	100	105
H–paste	7.7	8.0	8.4	8.7	8.5	8.6
Ce (mmho/cm)	0.40	0.40	0.50	0.65	0.80	3.5
a (me/l)						
..						
a ..						
g ..						
m of cations (me/l)						
O_3 (me/l)						
CO_3 ..						
..						
4 ..						
m of anions (me/l)						
j. SAR						
Clay mineralogy:						
O_2/Al_2O_3 (mol/mol)						
O_2/R_2O_3 ..						
$_2O_3$ (mmol%)						

ray report: A horizon: Mainly amorphous material, with very slight traces of illite.

Bt1 horizon: Illite and possibly traces of montmorillonite.

Depth (cm)	0–38	38–64	64–96	96–120	120–150	150–196
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	36	42	38	36	38	30
Silt % 0.05–0.002mm	6	4	4	6	4	8
Clay % 0.002–0 mm	58	54	58	58	58	62
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 30cm)		Laboratory no. 12740 / 79		
pH–H_2O (1:2½ v/v)	8.4		Available	Total
Exch. acidity (me/100g)	–	Na (me/100g)	0.47	
C%	0.42	K ..	0.69	
N%	–	Ca ..	28.4	
P–Olsen (ppm)		Mg ..	8.4	
		Mn ..	0.16	
		P (ppm)	20	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

LABORATORY DATA OF PROFILE DESCRIPTION No: 7 Continued.

D OBSERVATION No: 141-9 MAPPING UNIT: Ps 2.3 SOIL CLASSIFICATION: haplic XEROSOL

boratory no. ..... /79	12860	12861	12862	12863		
rizon	BC1	BC2	Ck1	Ck2		
pth (cm)	196–241	241–269	269–325	325–360		
–H_2O(1: 2½ v/v)	9.6	9.5	9.5	–		
–KCl ..						
(mmho/cm) ..	2.1	2.3	2.4	–		
CO_3 (%)	1.3	0.9	0.7	1.8		
SO_4(%)	0.1	0.2	1.2	0.1		
(%)						
(%)						
/N						
EC (me/100g). pH 8.2	33.4	48.2	43.0	49.8		
EC .. .. pH 7.0						
xch.Ca (me/100g)	6.7	4.9	12.5	7.7		
.. Mg ..						
.. K ..	0.7	0.5	0.8	0.9		
.. Na ..	17.5	18.0	10.8	22.2		
um of cations						
ase sat. %. pH 8.2						
.. .. %. pH 7.0						
SP at pH 8.2	52	37	25	45		
Saturation extract:						
oisture %	123	112	125	118		
H–paste	8.5	8.3	8.4	8.1		
Ce (mmho/cm)	6.5	5.5	6.5	14.0		
a (me/l)		52.0	63.0	132		
..		0.10	0.05	0.10		
a ..		0.50	0.50	2.50		
g ..		2.08	1.25	5.83		
um of cations(me/l)		55	65	140		
CO_3(me/l)		–	–	–		
HCO_3 ..		8.1	7.6	8.2		
l ..		42.5	53	127		
O_4 ..		2.9	3.4	5.7		
um of anions(me/l)		54	64	141		
SAR		46	68	[illegible]		
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X–ray report:

Depth (cm)	196–.	241–269	269–325	325–360		
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	26	32	30	28		
Silt % 0.05–0.002mm	6	2	8	8		
Clay % 0.002–0 mm	68	66	62	64		
Texture class	C	C	C	C		
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm) Laboratory no. /

			Available	Total
pH–H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79/50

Profile description no. 8

Observation/date	: 155-58, Garissa District, Bura East Project/7-7-79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.4
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Cymbopogon pospischillii, Dactyloctenium scindicum, Ehretia sp; bushed grassland
Salinity/sodicity	: Moderately saline from 160cm; strongly sodic from 85cm
Surface sealing	: Nil
Drainage class	: Moderately well drained

A 0-12cm

Dark reddish brown (5YR 4/4 dry; 5YR 3/3 moist); clay; moderate, very fine to fine crumb and moderate, very fine to fine subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; many very fine and fine and few medium pores; many, very fine and fine roots; pH-H_2O = 6.5; clear and smooth transition to:

(sample no. 155-58a)

Bwl 12-43cm

Reddish brown (5YR 5/6 dry; 5YR 4/4 moist);clay; moderate, fine to medium, angular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; few, weak slickensides; slightly calcareous; many very fine and fine and few medium pores; many very fine and fine and few medium roots; pH-H_2O = 7.3; gradual and smooth transition to:

(sample no. 155-58b)

Bw2 43-85cm

Dark reddish brown (5YR 3/3 dry and moist) clay; strong, very fine to medium, angular blocky structure; hard when dry, friable to firm when moist; sticky and plastic when wet; common, moderate slickensides; slightly calcareous; few calcium carbonate concretions, 1-2cm in diameter; common very fine and fine and few medium pores; common very fine and fine and few medium roots; pH-H_2O = 7.5; clear and wavy transition to:

(sample no. 155-58c)

Bw3 85-160cm

Dark brown to brown (7.5YR 5/6 dry; 7.5 4/4 moist); clay; moderate, medium to coarse, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few, weak slickensides; slightly calcareous; few, very fine to medium pores; few, very fine to medium roots; pH-H_2O = 8.0

(sample no. 155-58d)

Ck1	160-200cm	Yellowish brown (10YR 6/4 dry, 10YR 5/4 moist); clay; sticky and plastic when wet; slightly calcareous; 3-5% calcium carbonate nodules; $pH\text{-}H_2O = 8.0$ (sample no. 155-58e)
Ck2	200-244cm	Yellowish brown (10YR 6/4 dry, 10YR 5/4 moist); clay; sticky and plastic when wet; strongly calcareous; 1-3% calcium carbonate nodules; $pH\text{-}H_2O = 7.9$ (sample no. 155-58f)
C	244-348cm	Yellowish brown (10YR 5/4 moist) clay (sample nos. 155-58g and h)

Notes: 1) The Bw3 horizon is very compact.

2) The profile was augered from 160cm.

LABORATORY DATA OF PROFILE DESCRIPTION No: 8

FIELD OBSERVATION No: 155-58 MAPPING UNIT: Ps 2.4 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	10200	10201	10202	10203	10204	10205
Horizon	A	Bw1	Bw2	Bw3	Ck1	Ck2
Depth (cm)	0-12	12-43	43-85	85-160	160-200	200-244
pH-H_2O(1: 2½ v/v)	7.8	8.6	9.0	9.6	9.0	8.8
pH-KCl ,,	6.5	7.1	7.2	8.1	7.7	7.5
EC (mmho/cm) ,,	0.19	0.28	0.35	0.35	2.8	4.5
$CaCO_3$ (%)						
$CaSO_4$ (%)	tr	tr	tr	tr	tr	tr
C (%)	0.50	0.44	0.27	0.18	0.15	0.12
N (%)						
C/N						
CEC (me/100g), pH 8.2	38.0	32.0	34.0	34.0	46.0	41.2
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	22.0	28.0	23.0	22.0	19.4	16.4
,, Mg ,,	7.9	8.2	14.4	16.0	12.4	11.0
,, K ,,	2.9	1.5	1.3	1.3	1.2	0.9
,, Na ,,	1.3	2.4	3.6	13.7	16.4	17.6
Sum of cations	34	40	42	53	49	46
Base sat. %, pH 8.2	90	100+	100+	100+	100+	100+
,, ,, %, pH 7.0						
ESP at pH 8.2	3	8	11	40	36	43
Saturation extract:						
Moisture %	56	54	74	76	107	136
pH-paste	7.8	8.1	8.2	8.3	8.0	7.9
ECe (mmho/cm)	0.40	0.40	0.45	0.50	11.0	16.5
Na (me/l)	1.5	1.5	3.2	3.90	98.0	140
K ,,	0.45	0.19	0.13	0.10	0.32	0.35
Ca ,,	1.80	1.40	-	-	4.7	9.3
Mg ,,	1.10	1.40	-	-	7.1	16.6
Sum of cations (me/l)	4.8	4.5	-	-	110	166
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ,,	1.60	2.0	1.80	3.50	5.0	7.0
Cl ,,	2.00	1.90	2.00	1.00	100	150
SO_4 ,,	0.31	0.31	0.31	0.31	5.60	7.80
Sum of anions (me/l)	3.9	4.2	4.1	4.8	111	165
SAR	1	1	-	-	40	39
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3 (mmol%)						

X-ray report:

Depth (cm)	0-12	12-43	43-85	85-160	160-200	200-244
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	40	36	36	34	24	24
Silt % 0.05-0.002mm	4	8	8	8	12	12
Clay % 0.002-0 mm	56	56	56	58	64	64
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30 cm) Laboratory no. 10087 / 79

			Available	Total
pH-H_2O (1: v/v)	7.7		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	0.36	
C%	0.47	K ,,	1.08	
N%	-	Ca ,,	12.0	
P-Olsen (ppm)		Mg ,,	7.3	
		Mn ,,	0.68	
		P (ppm)	8	

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 8 Continued.

.D OBSERVATION No: 155-58 MAPPING UNIT: Ps 2.4 SOIL CLASSIFICATION: haplic XEROSOL

boratory no. ...../79	12852	12853				
rizon	c	c				
pth (cm)	244-300	300-348				
-H_2O(1: 2½ v/v)	–	–				
-KCl ..						
(mmho/cm) ..	–	–				
aCO_3 (%)						
aSO_4(%)	–	-				
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	37.4	33.4				
EC .. .. pH 7.0						
xch.Ca (me/100g)	7.7	8.7				
.. Mg ..	–	–				
.. K ..	0.8	1.3				
.. Na ..	16.9	21.8				
m of cations	–	–				
ase sat. %, pH 8.2	–	–				
.. .. %, pH 7.0						
SP at pH 8.2	45	65				
Saturation extract:						
oisture %	84	90				
-paste	7.8	7.9				
Ce (mmho/cm)	16.5	7.0				
a (me/l)	138	50.0				
..	0.21	0.19				
a ..	9.5	9.0				
g ..	17.9	15.5				
m of cations(me/l)	166	74.7				
O_3 (me/l)	0	0				
CO_3 ..	8.0	7.6				
..	153	65.0				
4 ..	3.40	4.4				
m of anions(me/l)	164	77.0				
SAR	37	14				
Clay mineralogy:						
O_2/Al_2O_3(mol/mol)						
O_2/R_2O_3 ..						
$_2O_3$(mmol%)						
-ray report:						

Depth (cm)	244-300	300-348				
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	26	28				
Silt % 0.05–0.002mm	10	10				
Clay % 0.002–0 mm	64	62				
Texture class	c	c				
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /		
pH–H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Profile description no. 9

Observation/date : 155-64, Garissa District, Bura East Project/11-7-79

Soil classification : haplic XEROSOL

Mapping unit : Ps 2.4

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Chrysopogon aucheri, Dactyloctenium scindicum, Aristida keniensis, Cordia sinensis, Maytenus sp; bushed grassland

Salinity/sodicity : Strongly saline from 77cm and strongly sodic from 30cm

Surface sealing : Nil

Drainage class : Moderately well drained

A 0-5cm Dark brown (10YR 6/2 dry; 10YR 3/3 moist); clay; moderate, very fine to fine subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; slightly calcareous; many macro and biopores; many, very fine and fine roots; pH-H_2O = 8.2; clear and smooth transition to:
(sample no. 155-64a)

Bw 5-30cm Dark yellowish brown (10YR 4/4 dry; 10YR 3/4 moist); clay; weak, coarse prismatic breaking to moderate, medium to coarse, subangular blocky structure; friable when moist, sticky and plastic when wet; strongly calcareous; many macro and bio pores; many very fine and fine and few medium roots; pH-H_2O = 8.3; clear and wavy transition to:
(sample no. 155-64b)

Bt 30-77cm Dark yellowish brown (10YR 3/4 moist); clay; moderate, medium to very coarse prismatic breaking to moderate, medium to coarse, angular blocky structure; firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; common macro and biopores; common, very fine and fine roots; pH-H_2O = 8.7; clear and smooth transition to: (sample no. 155-64c)

Btk 77-150cm Dark yellowish brown (10YR 4/4 moist); clay; moderate, fine to medium, angular blocky structure; friable when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; some pockets of soft powdery lime; common bio and few macro pores; common, very fine and fine roots; pH-H2O = 8.7 (77-115cm) and 7.8 (115-150cm)
(sample nos. 155-64d and e)

BC 150-180cm (augered) Yellowish brown (10YR 5/4 moist); clay; sticky and plastic when wet; strongly calcareous; pH-H_2O = 8.o

(sample no. 155-64f)

Note: Cracks extend into the Bt horizon and are partly filled up with sandy material from the topsoil.

LABORATORY DATA OF PROFILE DESCRIPTION No: 9

LDOBSERVATION No: 155-64 MAPPING UNIT: Pm 2.4 SOIL CLASSIFICATION: haplic XEROSOL

aboratory no. .....**/**79	10231	10232	10233	10234	10235	10236
orizon	A	Bw	Bt	Btk	Btk	BC
epth (cm)	0-5	5-30	30-77	77-115	115-150	150-180
H-H_2O(1: 2½ v/v)	8.5	8.4	9.0	9.0	8.3	8.1
H-KCl ,,	7.2	7.3	7.3	7.9	7.6	7.7
C(mmho/cm) ,,	0.20	0.24	0.22	3.0	6.0	5.5
aCO_3 (%)						
aSO_4 (%)	tr	tr	tr	tr	tr	tr
(%)	0.85	0.53	0.27	0.15	0.12	0.09
(%)						
/N						
EC (me/100g), pH 8.2	38.0	34.8	36.4	38.0	34.8	34.0
EC ,, ,, pH 7.0						
xch.Ca (me/100g)	48.5	42.0	42.5	40.0	42.0	45.6
,, Mg ,,	9.1	12.3	11.4	12.6	12.9	13.1
,, K ,,	1.1	0.5	0.5	0.4	0.5	1.5
,, Na ,,	2.6	2.8	8.4	11.9	14.9	19.5
um of cations	61	58	63	65	70	80
ase sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
,, ,, %, pH 7.0						
SP at pH 8.2	7	8	23	34	43	57
Saturation extract:						
oisture %	48	52	53	88	71	95
H-paste	8.1	8.1	7.8	8.1	7.4	8.3
Ce (mmho/cm)	0.55	0.65	0.80	7.0	14.0	21.5
a (me/l)	1.90	1.30	4.80	24.0	103	162
,,	0.49	0.32	0.13	0.19	0.32	0.26
a ,,	2.20	3.20	-	36.4	29.6	22.4
g ,,	1.10	2.10	2.10	7.5	-	29.5
um of cations(me/l)	5.7	6.9	-	69.9	-	214
O_3 (me/l)	0	0	0	0	0	0
CO_3 ,,	3.4	4.0	4.0	9.0	10.0	9.0
,,	2.10	1.92	3.65	54.0	118	195
$_4$,,	0.31	0.31	0.31	7.0	12.0	10.0
m of anions(me/l)	5.8	6.2	8.0	70.0	140	214
SAR	1	1	-	5	-	32
Clay mineralogy:						
O_2/Al_2O_3 (mol/mol)						
O_2/R_2O_3 ,,						
$_2O_3$ (mmol%)						

-ray report: A, Bt and Bw horizons: Traces of illite+montmorillonite, both of very poor crystallization.

Depth (cm)	0-5	5-30	30-77	77-115	115-150	150-180
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	44	40	44	42	40	32
Silt % 0.05–0.002mm	10	8	4	4	4	4
Clay % 0.002–0 mm	46	52	52	54	56	64
Texture class	SC/C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30cm) Laboratory no. 10053 / 79

			Available	Total
pH-H_2O (1:2½ v/v)	8.1		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	0.38	
C%	0.56	K ,,	0.58	
N%		Ca ,,	24.6	
P-Olsen (ppm)		Mg ,,	5.0	
		Mn ,,	0.07	
		P (ppm)	6	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 10

Observation/date : 155-65, Garissa District, Bura East Project/11-7-79
Soil classification : haplic XEROSOL
Mapping unit : Ps 2.4
Parent material : Marine/lacustrine sediments
Physiography : Sedimentary plain
Slope : Less than 0.5%
Vegetation : Dactyloctenium scindicum, Aristida keniensis, Acacia nubica, Acacia reficiens; bushed grassland.
Salinity/sodicity : Moderately saline from 104cm; strongly sodic from 47cm
Surface sealing : Nil
Drainage class : Moderately well drained

A 0-10cm Dark reddish brown (7.5YR 4/4 dry; 5YR 3/4 moist); clay; massive to weak, very fine and fine, subangular blocky structure; slightly hard when dry; friable when moist, sticky and plastic when wet; slightly calcareous; common very fine and fine and few medium pores; many, very fine and fine roots; pH-H_2O = 7.4; clear and smooth transition to:
(sample no. 155-65a)

AB 10-47cm Dark reddish brown (5YR 4/6 dry; 5YR 3/3 moist); weak, very fine subangular blocky structure; soft when dry, friable when moist, sticky and plastic when wet; moderately calcareous; abundant very fine and few fine pores; many, very fine and fine roots; pH-H_2O = 7.8; gradual and smooth transition to:
(sample no. 155-65b)

Bt 47-104cm Dark reddish brown (5YR 3/4 dry; 5YR 3/3 moist); clay; weak, fine to medium prismatic breaking to weak, fine to medium, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; moderately calcareous; common, very fine pores; common very fine and few fine roots; pH-H_2O = 8.6; gradual and smooth transition to:
(sample no. 155-65c)

BC 104-152cm Reddish brown (5YR 5/6 dry; 5YR 4/4 moist); clay; weak, medium, angular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; common very fine and fine and few medium pores; pH-H_2O = 8.0;
(sample no. 155-65d)

C1	152-208cm	Dark brown to brown (10YR 5/4 dry, 10YR 4/3 moist); clay; sticky and plastic when wet; moderately calcareous; pH-H_2O= 7.6 (sample no. 155-65e)
C2	208-317cm	Dark brown to brown (10YR 4/3 moist); clay; (sample nos. 155-65f, g, h and k)
C3	317-380cm	Brown (10YR 5/3 moist); clay; (sample no. 155-65l)

Note: The profile was augered from 152 cm.

LABORATORY DATA OF PROFILE DESCRIPTION No: 10

ELD OBSERVATION No: 155-65   MAPPING UNIT: Ps 2.4   SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	10237	10238	10239	10240	10241	10245
Horizon	A	AB	Bt	BC	C1	C2
Depth (cm)	0–10	10–47	47–104	104–152	152–208	208–235
pH–H_2O(1: 2½ v/v)	8.1	8.5	8.7	9.0	8.8	–
pH–KCl ,,	7.1	7.2	7.3	7.6	7.8	–
EC (mmho/cm) ,,	0.30	0.16	0.35	2.3	4.4	–
$CaCO_3$ (%)	–	–	–	–	–	1.4
$CaSO_4$ (%)	0.1	0.1	0.5	0.1	1.2	–
C (%)	0.53	0.41	0.12	0.06	0.09	–
N (%)						
C/N						
CEC (me/100g), pH 8.2	40.0	34.8	38.0	41.2	41.2	33.4
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	26.0	24.4	32.0	34.0	32.0	3.0
,, Mg ,,	11.1	12.6	12.4	15.6	8.0	–
,, K ,,	1.1	0.9	0.9	1.0	0.8	0.3
,, Na ,,	2.1	2.9	6.9	11.0	14.2	15.2
Sum of cations	40	41	52	62	55	–
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	–
,, ,, %, pH 7.0						
ESP at pH 8.2	5	8	18	27	34	46
Saturation extract:						
Moisture %	47	149	56	64	89	71
pH–paste	8.5	8.6	8.1	7.7	8.3	7.6
ECe (mmho/cm)	0.75	0.45	0.24	11.0	17.5	20.5
Na (me/l)	3.00	1.80	1.82	92.0	145	172
K ,,	0.80	0.26	0.13	0.32	0.45	0.31
Ca ,,	2.5	–	–	5.2	12.8	9.00
Mg ,,	1.4	–	–	11.1	17.7	23.3
Sum of cations (me/l)	7.7	–	–	109	176	206
CO_3 (me/l)	2.00	2.25	–	–	–	0
HCO_3 ,,	4.0	1.0	0.90	8.0	9.0	7.0
Cl ,,	2.90	1.00	1.10	98.2	161	187
SO_4 ,,	0.31	0.31	0.31	2.2	4.7	5.30
Sum of anions (me/l)	9.2	4.6	2.3	108	175	199
SAR	2	–	–	32	37	43
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3 (mmol%)						

X–ray report: A-horizon: Traces of very poorly crystallized illite.
AB-horizon: Traces of illite and montmorillonite, both very poorly crystallized.

Depth (cm)	0–10	10–47	47–104	104–152	152–208	208–235
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	44	40	40	38	32	26
Silt % 0.05–0.002 mm	6	4	4	2	6	10
Clay % 0.002–0 mm	50	56	56	60	62	64
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0 mm						
,, ,, 1.0 – 0.50 mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10 mm						
,, ,, 0.10 – 0.05 mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 30cm)   Laboratory no. 10094/79

			Available	Total
pH–H_2O (1:2½ v/v)	7.8		Available	Total
Exch. acidity (me/100g)	–	Na (me/100g)	0.30	
C%	0.62	K ,,	1.50	
N%	–	Ca ,,	13.4	
P–Olsen (ppm)		Mg ,,	6.1	
		Mn ,,	0.61	
		P (ppm)	11	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

LABORATORY DATA OF PROFILE DESCRIPTION No: 10 Continued.

FIELD OBSERVATION No: 155-65 MAPPING UNIT: Pe 2.4 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	12846	12847	12848	12849		
Horizon	C2	C2	C2	C3		
Depth (cm)	235–275	275–296	296–317	317–380		
pH–H_2O (1:2½ v/v)	–	–	–	–		
pH–KCl ,,						
EC (mmho/cm) ,,	–	–	–	–		
$CaCO_3$ (%)	2.2	1.0	1.4	0.8		
$CaSO_4$ (%)	–	–	–	–		
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	32.2	33.4	–	37.4		
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	8.7	8.7	–	3.0		
,, Mg ,,	–	–	–	–		
,, K ,,	1.5	0.6	–	0.4		
,, Na ,,	18.0	14.0	–	11.6		
Sum of cations	–	–	–	–		
Base sat. %, pH 8.2	–	–	–	–		
,, ,, %, pH 7.0						
ESP at pH 8.2	47	42	–	31		
Saturation extract:						
Moisture %	89	79	105	101		
pH–paste	7.9	8.0	7.6	8.0		
ECe (mmho/cm)	4.0	8.0	4.5	5.0		
Na (me/l)	20.0	60.0	34.0	38.0		
K ,,	0.32	0.31	0.13	0.19		
Ca ,,	9.50	9.50	4.00	5.00		
Mg ,,	8.73	8.75	7.08	6.25		
Sum of cations (me/l)	38.6	78.6	45.2	49.4		
CO_3 (me/l)	0	0	0	0		
HCO_3 ,,	8.0	8.0	7.7	6.9		
Cl ,,	31.5	69.0	36.0	41.0		
SO_4 ,,	0.40	1.30	1.1	1.1		
Sum of anions (me/l)	39.9	78.3	44.8	49.0		
SAR	79	20	14	16		
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3 (mmol%)						

X–ray report:

Depth (cm)	235–275	275–296	296–317	317–380		
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	26	32	28	26		
Silt % 0.05–0.002mm	10	8	10	8		
Clay % 0.002–0 mm	64	60	62	66		
Texture class	C	C	C	C		
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH–H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ,,		
N%		Ca ,,		
P–Olsen (ppm)		Mg ,,		
		Mn ,,		
		P (ppm)		

Various:

Remarks:

Profile description no. 11

Observation/date	: 141-5, Garissa district, Bura East project/16-3-79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.5
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Acacia reficiens, Dactyloctenium scindicum, Aristida keniensis; bushed grassland
Salinity/sodicity	: Slightly to moderately saline from 43cm and strongly sodic from 22cm
Surface sealing	: Weak sealing, 2-5mm thick
Drainage class	: Imperfectly drained

A 0-10cm Brown (10YR 5/3 dry; 10YR 5/3 moist); sandy clay; weak, fine subangular blocky with tendency to weak, very fine crumby structure; soft when dry, friable when moist, sticky and plastic when wet; many macro and few biopores; many, very fine and fine roots; pH-H_2O = 7.8; clear and smooth transition to:

(sample no. 141-5a)

AB 10-22cm Dark greyish brown (10YR 5/3 dry; 10YR 4/2 moist); sandy clay; porous massive with tendency to weak, very fine and fine, crumby structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many macro and few biopores; many very fine and fine and few medium roots; pH-H_2O = 8.5; clear and wavy transition to:

(sample no. 141-5b)

Bu 22-43cm Dark greyish brown (10YR 5/3 dry; 10YR 4/2 moist); clay; moderate, medium subangular blocky structure; slightly hard when dry,friable to firm when moist, sticky and plastic when wet; strongly calcareous; many macro and few biopores; many very fine and fine roots; pH-H_2O = 8.6; gradual and smooth transition to:

(sample no. 141-5c)

Btk1 43-90cm

Dark grey (10YR 4/2 dry; 10YR 4/1 moist); clay; moderate, coarse to very coarse, prismatic with tendency to moderate, fine to medium, subangular blocky structure; slightly hard when dry, friable to firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; some pockets of soft powdery lime; few macro and biopores; common, very fine and fine roots; pH-H_2O = 8.4; gradual and smooth transition to:

(sample no. 141-5d)

Btk2 90-125cm

Dark greyish brown (10YR 5/3 dry; 10YR 4/2 moist); clay; porous massive; sticky and plastic when wet; broken, thick clayskins; strongly calcareous; some pockets of soft powdery lime; few macro pores; few, very fine and fine roots; pH-H_2O = 8.4

(sample no. 141-5e)

LABORATORY DATA OF PROFILE DESCRIPTION No: 11

FIELD OBSERVATION No: 141-5 MAPPING UNIT: Ps 2.5 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	4983	4984	4985	4986	4987	
Horizon	A	AB	Bu	Btk1	Btk2	
Depth (cm)	0-10	10-22	22-43	43-90	90-125	
pH-H_2O(1:2½ v/v)	8.4	8.8	9.0	8.7	8.9	
pH-KCl ,,	7.1	7.0	7.2	7.4	7.6	
EC(mmho/cm) ,,	0.30	0.20	0.40	2.2	3.5	
$CaCO_3$(%)	0.2	1.2	4.4	5.4	6.4	
$CaSO_4$(%)	0.1	0.2	0.1	tr	tr	
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	30.7	31.6	30.2	33.1	35.6	
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	30.0	69.5	57.0	41.5	54.0	
,, Mg ,,	1.8	3.2	4.1	4.1	4.4	
,, K ,,	4.3	3.6	1.2	2.2	2.5	
,, Na ,,	0.9	1.4	6.8	14.6	13.1	
Sum of cations	37	78	69	62	74	
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	
,, ,, %, pH 7.0						
ESP at pH 8.2	3	4	23	44	37	
Saturation extract:						
Moisture %						
pH-paste						
ECe (mmho/cm)						
Na (me/l)						
K ,,						
Ca ,,						
Mg ,,						
Sum of cations(me/l)						
CO_3 (me/l)						
HCO_3 ,,						
Cl ,,						
SO_4 ,,						
Sum of anions(me/l)						
Adj. SAR						
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report: A, AB and Bu horizons: Mainly amorphous material, with traces of poorly crystallized illite.

Depth (cm)	0-10	10-22	22-43	43-90	90-125	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	44	40	38	38	32	
Silt % 0.05–0.002mm	8	8	8	8	8	
Clay % 0.002–0 mm	48	52	54	54	60	
Texture class	SC	SC	C	C	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 30cm) Laboratory no. 11713 / 79

			Available	Total
pH-H_2O (1:2½ v/v)	8.1			
Exch. acidity (me/100g)	-	Na (me/100g)	0.79	
C%	0.56	K ,,	0.70	
N%		Ca ,,	19.6	
P-Olsen(ppm)		Mg ,,	5.7	
		Mn ,,	0.40	
		P (ppm)	44	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 12

Observation/date	: 141-6, Garissa district, Bura East project/7-7-79
Soil classfication	: haplic XEROSOL
Mapping unit	: Ps 2.5
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Acacia reficiens, Duosperma eremophilum, Dactyloctenium scindicum, Chloris roxburghiana, Chrysopogon aucheri; bushed grassland
Salinity/sodicity	: Moderately saline from 98cm and strongly sodic from 28cm
Surface sealing	: Nil
Drainage class	: Imperfectly drained

A 0-6cm Greyish brown (10YR 5/2 moist); sandy clay; massive; friable when moist, sticky and plastic when wet; strongly calcareous; many very fine and fine and common medium pores; many, fine and medium roots; pH-H_2O = 7.0; clear and smooth transition to:
(sample no. 141-6a)

AB 6-28cm Dark greyish brown (10YR 4/2 moist); clay; massive, with tendency to weak, very fine and fine, subangular blocky structure; friable when moist, sticky and plastic when wet; strongly calcareous; common, very fine and fine pores; many, fine and medium roots; pH-H_2O = 7.4; clear and wavy transition to:
(sample no. 141-6b)

Bt 28-54cm Very dark greyish brown (10YR 3/2 moist); clay; moderate, medium to coarse, subangular blocky structure; friable when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; few, very fine and fine pores; few, fine roots; pH-H_2O = 7.9; gradual and smooth transition to:
(sample no. 141-6c)

Bky 54-98cm Very dark greyish brown (10YR 3/2 moist); clay; weak, fine to medium, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; strongly calcareous; pockets of soft powdery lime and gypsum crystals (less than 5%); few, very fine and fine pores; very few fine roots; pH-H_2O = 8.2; gradual and smooth transition to:
(sample no. 141-6d)

BCky 98-150cm Dark grey (10YR 4/1 moist); clay; weak, very fine to fine, subangular blocky structure; friable to firm when moist, sticky and plastic when wet; strongly calcareous; pockets of soft powdery lime and gypsum crystals (less than 10%); common very fine pores; pH-H_2O = 7.9.

(sample no. 141-6e)

LABORATORY DATA OF PROFILE DESCRIPTION No: 12

FIELDOBSERVATION No: 141-6 MAPPING UNIT: Ps 2.5 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	10101	10102	10103	10104	10105	
Horizon	A	AB	Bt	Bky	BCky	
Depth (cm)	0-6	6-28	28-54	54-98	98-150	
pH-H_2O(1: 2½ v/v)	8.1	8.4	9.2	9.6	10.0	
pH-KCl ,,	6.8	7.3	7.4	7.9	7.7	
EC(mmho/cm) ,,	0.24	0.14	0.50	0.60	5.0	
$CaCO_3$ (%)						
$CaSO_4$ (%)	tr	tr	tr	0.1	0.1	
C (%)	0.74	0.45	0.36	0.30	0.24	
N (%)						
C/N						
CEC (me/100g), pH 8.2	20.0	26.4	38.0	41.2	48.0	
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	32.0	46.5	47.5	40.0	66.0	
,, Mg ,,	5.7	8.1	12.2	13.8	14.0	
,, K ,,	1.4	2.2	1.1	1.7	1.3	
,, Na ,,	1.1	2.1	7.9	16.4	19.8	
Sum of cations	40	59	69	72	101	
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	
,, ,, %, pH 7.0						
ESP at pH 8.2	6	8	21	40	41	
Saturation extract:						
Moisture %	43	58	63	90	93	
pH-paste	8.4	8.2	8.7	8.9	8.2	
ECe (mmho/cm)	1.35	0.40	0.60	1.30	11.5	
Na (me/l)	3.5	1.2	5.0	11.0	85.0	
K ,,	0.76	0.92	0.27	0.22	0.54	
Ca ,,	6.75	1.38	tr	0.50	14.1	
Mg ,,	2.29	1.25	0.42	0.83	14.8	
Sum of cations(me/l)	13.3	4.8	5.7	12.6	114	
CO_3 (me/l)	2.05	1.01	2.35	3.00	1.00	
HCO_3 ,,	6.70	1.00	2.30	6.35	10.0	
Cl ,,	3.2	1.90	1.00	3.00	90.0	
SO_4 ,,	1.40	0.31	0.31	1.40	14.2	
Sum of anions(me/l)	13.4	4.2	6.0	13.8	115	
SAR	2	1	11	13	22	
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report: A, AB and Bt horizons: Mainly amorphous material with traces of poorly crystallized illite.

Depth (cm)	0-6	6-28	28-54	54-98	98-150	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	50	42	40	38	36	
Silt % 0.05–0.002mm	2	4	2	4	0	
Clay % 0.002–0 mm	48	54	58	58	64	
Texture class	SC	C	C	C	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm) Laboratory no. /

			Available	Total
pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ,,		
N%		Ca ,,		
P-Olsen (ppm)		Mg ,,		
		Mn ,,		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 13

Observation/date : 155-79; Garissa district; Bura East Irrigation project/ 8/9/79

Soil classification : haplic XEROSOL

Mapping unit : Ps 2.6

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plains

Slope : Less than 0.5%

Vegetation : Chrysopogon aucheri, Sporobolus helvolus, Combretum hereroense, Indigofera schimperi; bushed grassland

Salinity/sodicity : Moderately saline from 62cm and strongly saline from 100cm; moderately sodic from 30cm and strongly sodic from 62cm

Surface sealing : 1-3mm thick, weak

Drainage class : Imperfectly drained

A 0-14cm Dark brown (10YR 4/3 dry; 10YR 3/3 moist); sandy clay; moderate, very fine to medium crumby structure; slightly hard when dry, friable when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; many, very fine and fine pores; many very fine and fine, few medium roots; pH-H_2O = 8.0; clear and wavy transition to:

(sample no. 155-79a)

Bw 14-30cm Dark brown to brown (10YR 4/3 moist); clay; moderate, fine to medium, prismatic structure breaking into weak, fine to medium angular blocky; hard when dry, friable when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; common, very fine and fine pores; common very fine and fine, few medium roots; pH-H_2O= 8.7; gradual and smooth transition to:

(sample no. 155-79b)

Btk 30-62cm Dark brown to brown (10YR 4/3 moist); clay; moderate, coarse to very coarse, prismatic structure breaking into weak, medium to coarse, angular blocky; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; few pockets of soft powdery lime (1%); few, very fine and fine pores; few, very fine and fine roots; pH-H_2O = 8.0; clear and smooth transition to:

(sample no. 155-79c)

Btky 62-100cm

Brown (10YR 5/3 moist); clay; weak, coarse, prismatic structure breaking into strong, very fine and fine, angular blocky; hard when dry, firm when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; many pockets of soft powdery lime and many gypsum crystals; common, very fine and fine pores; very few, very fine roots; $pH-H_2O = 7.9$; diffuse and smooth transition to:

(sample no. 155-79d)

BCy 100-172 cm

Greyish brown (10YR 5/2 moist); clay; strong, very fine and fine, angular blocky structure; friable when moist, sticky and plastic when wet; common, moderate slickensides; strongly calcareous; many gypsum crystals; few, very fine pores; very few, dead roots; $pH-H_2O = 8.4$;

(sample nos. 155-79e and f)

C 172-228cm (augered)

Grey (10YR 5/1 moist); clay; sticky and plastic when wet; non-calcareous; $pH-H_2O = 8.0$.

(sample no. 155-79g)

Note: Cracks extend into the Btk horizon and are partly filled up with sandy material from the topsoil.

LABORATORY DATA OF PROFILE DESCRIPTION No: 13

LD OBSERVATION No: 155-79 MAPPING UNIT: Pa 2.6 SOIL CLASSIFICATION: haplic XEROSOL

aboratory no. ...../79	12918	12919	12920	12921	12922	12923
orizon	A	Bw	Btk	Btky	BCy	BCy
epth (cm)	0-14	14-30	30-62	62-100	100-120	120-172
H-H_2O(1: 2½ v/v)	8.3	8.5	8.4	7.8	8.1	7.8
H-KCl "						
C (mmho/cm) ..	0.30	0.30	0.50	3.0	7.5	8.0
aCO_3(%)	2.0	3.2	4.2	3.1	2.0	2.3
aSO_4(%)	tr	tr	tr	0.4	0.5	0.3
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	39.0	35.8	31.5	33.4	43.0	39.8
EC " " pH 7.0						
xch.Ca (me/100g)	56.6	61.2	61.2	18.2	22.2	8.6
" Mg "	1.5	2.8	3.4	–	–	–
" K "	1.6	1.1	0.9	0.6	0.4	0.2
" Na "	0.7	2.1	4.6	21.4	16.3	13.9
m of cations	60	67	70	–	–	–
se sat. %, pH 8.2	100+	100+	100+	100+	–	–
" " %, pH 7.0						
P at pH 8.2	2	9	15	64	38	35
aturation extract:						
isture %	57	60	82	75	110	114
-paste	7.5	7.9	8.1	7.1	7.6	7.5
e (mmho/cm)	0.50	0.60	0.45	8.5	15.5	18.0
(me/l)	1.00	2.00	1.50	33.0	122	150
"	0.20	0.20	0.25	0.17	0.14	0.19
"	1.50	2.00	2.00	28.0	15.5	13.0
"	2.38	2.38	0.63	23.8	18.3	18.3
m of cations(me/l)	5.1	6.6	4.4	85.0	156	181
$_3$(me/l)	0	0	0	0	0	0
O_3 "	1.25	2.50	2.00	7.20	6.00	7.85
"	3.35	3.00	1.50	69.0	138	165
"	0.94	0.94	0.94	9.40	11.8	7.50
of anions(me/l)	5.5	6.4	4.4	85.6	156	180
SAR	1	1	1	6	30	38
lay mineralogy:						
$_2/Al_2O_3$(mol/mol)						
$_2/R_2O_3$ "						
O_3(mmol%)						
ay report:						

Depth (cm)	0-14	14-30	30-62	62-100	100-123	123-172
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	50	42	40	38	36	36
Silt % 0.05–0.002mm	6	8	10	2	8	6
Clay % 0.002–0 mm	44	50	50	60	56	58
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
" " 1.0 – 0.50mm						
" " 0.50 – 0.25mm						
" " 0.25 – 0.10mm						
" " 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30cm)		Laboratory no. 12729 / 79		
pH-H_2O (1: 2½v/v)	8.1		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	0.84	
C%	0.71	K "	0.37	
N%	-	Ca "	30.4	
P-Olsen (ppm)		Mg "	6.0	
		Mn "	0.02	
		P (ppm)	6	

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 13 Continued.

FIELD OBSERVATION No: 155-79 MAPPING UNIT: Ps 2.6 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	12924					
Horizon	C					
Depth (cm)	172-200					
pH-H_2O(1: 2½ v/v)	7.7					
pH-KCl ..						
EC(mmho/cm) ..	10.0					
$CaCO_3$(%)	tr					
$CaSO_4$(%)	1.2					
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	41.4					
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	20.2					
.. Mg ..	–					
.. K ..	0.4					
.. Na ..	20.6					
Sum of cations	–					
Base sat. %, pH 8.2	–					
.. .. %, pH 7.0						
ESP at pH 8.2	50					
Saturation extract:						
Moisture %	141					
pH-paste	7.6					
ECe (mmho/cm)	16.0					
Na (me/l)	141					
K ..	0.25					
Ca ..	8.50					
Mg ..	12.5					
Sum of cations(me/l)	162					
CO_3(me/l)	0					
HCO_3 ..	7.85					
Cl ..	148					
SO_4 ..	4.70					
Sum of anions(me/l)	161					
SAR	44					
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	172-200					
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	28					
Silt % 0.05–0.002mm	8					
Clay % 0.002–0 mm	64					
Texture class	C					
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /		
pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 78050

Profile description no. 14

Observation/date	: 155-97, Garissa district, Bura East project/13-9-79
Soil classification	: luvic XEROSOL
Mapping unit	: Ps 2.6
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Ehretia sp., Maytenus sp., Dactyloctenium scindicum, Chloris roxburghiana; bushed grassland
Salinity/sodicity	: Moderately saline from 69cm and strongly saline from 101cm; strongly sodic from 34cm
Surface sealing	: 1mm thick, weak
Drainage class	: Imperfectly drained

A 0-5cm Grey (10YR 7/1 dry; 10YR 5/1 moist); clay; porous massive with tendency to weak, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; slightly calcareous; many very fine and fine, few medium pores; many, very fine and fine roots; pH-H_2O = 8.0; clear and smooth transition to: (sample no. 155-97a)

AB 5-34cm Dark grey (10YR 5/1 dry, 10YR 4/1 moist); clay; weak, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine, common fine, few medium pores; many very fine and fine, few medium roots; pH-H_2O = 8.5; gradual and smooth transition to: (sample no. 155-97b)

Btk 34-69cm Dark greyish brown (10YR 4/2 moist); clay; weak, coarse, prismatic structure with tendency to moderate, medium to coarse, subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; broken moderately thick clayskins; strongly calcareous; few pockets of soft powdery lime; common very fine and fine, few medium pores; very few, very fine roots; pH-H_2O = 8.8; diffuse and smooth transition to:

(sample no. 155-97c)

Bt1 69-101cm Greyish brown (10YR 5/2 moist); clay; weak, moderate to coarse, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few very fine pores; pH-H_2O = 8.6; gradual and smooth transition to: (sample no. 155-97d)

Bt2	101-163cm	Dark greyish brown (10YR 4/2 moist); clay; weak, medium to coarse, angular blocky structure; friable when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; common very fine pores; pH - H_2O = 8.0 (sample no. 155-97e and f)
BC	163-202cm	Pale brown (10YR 6/3 moist); clay; sticky and plastic when wet; moderately calcareous; pH-H_2O = 7.8 (sample no. 155-97g)
Ck	202-223cm	Grey (10YR 6/1 moist); gravelly clay; sticky and plastic when wet; slightly calcareous; many calcium carbonate nodules; pH-H_2O = 7.9 (sample no. 155-97h)
C1	223-244cm	Greyish brown (10YR 5/2 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 7.7 (sample no. 155-97j)
C2	244-279cm	Pale brown (10YR 6/3 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 8.2 (sample no. 155-97k)
C3	279-349cm	Brown 10YR 5/3 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 8.0 (sample nos. 155-971 and m)

Note: 1) The Btk and Btl horizons are very compact.
2) Profile was augered from 163cm onwards.

LABORATORY DATA OF PROFILE DESCRIPTION No: 14

FIELD OBSERVATION No: 155-97 **MAPPING UNIT:** Ps 2.6 **SOIL CLASSIFICATION:** luvic XEROSOL

Laboratory no. ...../79	12976	12977	12978	12979	12980	12981
Horizon	A	AB	Btk	Bt1	Bt2	Bt2
Depth (cm)	0-5	5-34	34-69	69-101	101-120	120-163
pH-H_2O (1: 2½ v/v)	8.1	8.3	9.1	9.5	8.8	8.6
pH-KCl ,,						
EC (mmho/cm) ,,	0.45	0.40	0.80	1.9	7.0	6.0
$CaCO_3$ (%)	1.6	4.0	4.3	4.4	3.8	2.1
$CaSO_4$ (%)	0.1	0.1	0.7	0.8	1.2	0.1
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	32.5	35.4	33.0	34.6	33.4	34.6
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	49.0	57.0	48.0	22.2	20.2	22.2
,, Mg ,,	2.9	1.6	5.6	-	-	-
,, K ,,	3.6	2.3	2.0	0.3	0.2	1.2
,, Na ,,	1.0	1.3	11.3	11.0	11.6	8.2
Sum of cations	57	62	67	-	-	-
Base sat. %, pH 8.2	100+	100+	100+	-	-	-
,, ,, %, pH 7.0						
ESP at pH 8.2	3	4	34	32	35	24
Saturation extract:						
Moisture %	44	61	90	102	85	100
pH-paste	7.7	8.1	8.6	8.4	7.6	7.5
ECe (mmho/cm)	0.90	0.40	0.35	5.0	20.0	21.5
Na (me/l)	4.25	3.25	-	38.0	136	169
K ,,	0.28	0.13	-	0.35	0.13	0.18
Ca ,,	5.00	0.75	-	1.50	16.0	17.3
Mg ,,	1.88	1.04	-	2.71	31.7	30.8
Sum of cations (me/l)	11.4	5.2	-	426	184	217
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ,,	6.66	4.66	7.33	7.99	9.33	10.7
Cl ,,	2.15	1.00	-	36.6	177	189
SO_4 ,,	0.30	0	0.30	1.90	13.1	10.9
Sum of anions (me/l)	9.11	5.7	-	46.5	199	211
SAR	2	4	-	26	28	34
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3 (mmol%)						

X-ray report: A, AB and Btk horizons: Traces of very poorly crystallized illite and montmorillonite.

Depth (cm)	0-5	5-34	34-69	69-101	101-120	120-163
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	42	38	32	28	22	26
Silt % 0.05-0.002mm	6	4	10	10	8	6
Clay % 0.002-0 mm	52	58	58	62	70	68
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30 cm) Laboratory no. 12741 / 79

			Available	Total
pH-H_2O (1: 2½ v/v)	8.3		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	1.01	
C%	0.48	K ,,	0.37	
N%	-	Ca ,,	28.4	
P-Olsen (ppm)		Mg ,,	7.4	
		Mn ,,	0.02	
		P (ppm)	8	

Various:

Remarks:

Kenya Soil Survey
Drawing No 79050

LABORATORY DATA OF PROFILE DESCRIPTION No: 14 Continued.

ELDOBSERVATION No: 155-97 MAPPING UNIT: Ps 2.6 SOIL CLASSIFICATION: luvic XEROSOL

Laboratory no. ...../79	12982	12983	12984	12985	12986	12987
Horizon	BC	Ck	C1	C2	C3	C3
Depth (cm)	163-202	202-223	223-244	244-279	279-335	335-349
pH-H_2O(1:2½ v/v)	8.4	8.7	8.2	8.4	8.2	8.5
pH-KCl ,,						
EC(mmho/cm) ,,	5.0	4.0	5.0	5.5	5.0	4.5
$CaCO_3$(%)	2.0	6.0	0.4	6.0	0.2	0.6
$CaSO_4$(%)	0.1	0.1	0.1	0.7	0.8	-
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	35.0	30.2	33.4	39.8	46.6	33.4
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	22.2	20.2	44.2	22.2	15.7	23.7
,, Mg ,,	-	-	-	-	-	-
,, K ,,	1.2	1.2	0.1	0.1	0.2	0.2
,, Na ,,	7.7	7.0	8.4	10.6	9.3	7.7
Sum of cations	-	-	-	-	-	-
Base sat. %, pH 8.2						
,, ,, %, pH 7.0						
ESP at pH 8.2	22	23	25	27	20	23
Saturation extract:						
Moisture %	117	-	123	116	112	-
pH-paste	7.9	-	7.8	7.9	7.8	-
ECe (mmho/cm)	13.0	-	16.5	15.5	11.0	-
Na (me/l)	110	-	133	130	96.0	-
K ,,	0.23	-	0.35	0.26	0.30	-
Ca ,,	7.00	-	12.0	9.0	5.0	-
Mg ,,	12.9	-	18.7	15.4	9.36	-
Sum of cations(me/l)	129	-	164	155	111	-
CO_3(me/l)	0	-	0	0	0	-
HCO_3 ,,	7.33	-	7.99	9.99	9.33	-
Cl ,,	117	-	150	140	97.0	-
SO_4 ,,	6.10	-	7.7	5.5	3.9	-
Sum of anions(me/l)	130	-	166	155	110	-
SAR	35	-	34	37	36	-
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	163-202	202-223	223-244	244-279	279-335	335-349
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	22	32	22	24	28	26
Silt % 0.05-0.002mm	8	10	8	6	4	4
Clay % 0.002-0 mm	70	58	70	70	68	70
Texture class	c	c	c	c	c	c
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0- cm)		Laboratory no. /	Available	Total
pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ,,		
N%		Ca ,,		
P-Olsen(ppm)		Mg ,,		
		Mn ,,		
		P (ppm)		

Various·

Remarks:

Profile description no. 15

Observation/date	: 155-72; Garissa district, Bura East Irrigation Project/ 1-8-79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.6
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Dactyloctenium scindicum, Tetrapogon tenellus, cordia sinensis, Commiphora riparia, Terminalia spinosa; bushland
Salinity/sodicity	: Non-saline and non-sodic
Surface sealing	: Nil
Drainage	: Imperfectly drained

A 0-11cm Greyish brown (10YR 6/2 dry, 10YR 5/2 moist); clay; massive to weak, coarse and very coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; non-calcareous; common, very fine and fine pores; abundant fine and few medium roots; pH-H_2O = 7.5; clear and wavy transition to: (sample no. 155-72a)

Bw1 11-30cm Dark greyish brown (10YR 4/2 moist); clay; weak, very fine to fine, subangular blocky structure; friable when moist, sticky and plastic when wet; non-calcareous; many, very fine and fine pores; abundant fine and few medium roots; pH-H_2O = 7.7; gradual and wavy transition to: (sample no. 155-72b)

Bw2 30-51cm Dark greyish brown (10YR 4/2 moist); clay; weak, very fine and fine, subangular blocky structure; friable when moist, sticky and plastic when wet; non-calcareous; common, very fine and fine and few medium roots; pH-H_2O = 8.0; gradual and smooth transition to: (sample no. 155-72c)

Bt 51-140cm Dark greyish brown (10YR 4/2 moist); clay; moderate, fine to medium, subangular blocky structure with tendency to angular blocky; firm when moist, sticky and plastic when wet; few, moderately thick clayskins; slightly calcareous; few, very fine and fine pores; few, fine roots; pH-H_2O = 8.0 (sample no. 155-72d)

Ck 140-220cm Light brownish grey (10YR 7/2 dry, 10YR 6/2 moist); gravelly clay; sticky and plastic when wet; strongly calcareous; some calcium carbonate nodules; pH-H_2O = 8.8 (sample no. 155-72e)

C 220-300cm Pale brown (10YR 6/2 moist); clay; sticky and plastic when wet; strongly calcareous. (sample no. 155-72f)

LABORATORY DATA OF PROFILE DESCRIPTION No: 15

ELD OBSERVATION No: 155-72 MAPPING UNIT: Ps 2.6 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. .....√ 79	11658	11659	11660	11661	11662	13002
Horizon	A	Bw1	Bw2	Bt	Ck	C
Depth (cm)	0-11	11-30	30-51	51-140	140-220	220-300
pH-H_2O(1: 2½ v/v)	8.0	8.3	8.3	8.3	8.5	8.9
pH-KCl ,,	6.1	6.7	7.0	7.0	7.5	7.8
EC (mmho/cm) ,,	0.15	0.09	0.10	0.11	0.20	0.30
$CaCO_3$ (%)	-	-	-	-	-	2.1
$CaSO_4$ (%)	tr	tr	tr	1.2	1.2	-
C (%)	0.74	0.50	0.36	0.18	0.09	0.11
N (%)						
C/N						
CEC (me/100g), pH 8.2	38.8	40.0	42.8	42.8	40.0	43.0
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	22.0	24.0	21.0	23.0	28.0	16.7
,, Mg ,,	8.2	9.4	8.8	13.6	15.2	-
,, K ,,	3.2	2.3	1.7	2.2	1.9	0.66
,, Na ,,	1.2	1.2	1.2	1.7	3.3	14.4
Sum of cations	35	37	33	41	48	-
Base sat. %, pH 8.2	89	92	76	95	100+	-
,, ,, %, pH 7.0						
ESP at pH 8.2	3	3	3	4	8	33
Saturation extract:						
Moisture %						
pH-paste						
ECe (mmho/cm)						
Na (me/l)						
K ,,						
Ca ,,						
Mg ,,						
Sum of cations (me/l)						
CO_3 (me/l)						
HCO_3 ,,						
Cl ,,						
SO_4 ,,						
Sum of anions (me/l)						
Adj. SAR						
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3 (mmol%)						

X-ray report:

Depth (cm)	0-11	11-30	30-51	51-140	140-220	220-300
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	38	34	34	30	36	28
Silt % 0.05–0.002mm	2	4	6	6	10	10
Clay % 0.002–0 mm	60	62	60	64	54	62
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 30cm) Laboratory no. 11677 / 79

			Available	Total
pH-H_2O (1: 2½ v/v)	7.2			
Exch. acidity (me/100g)	-	Na (me/100g)	0.17	
C%	0.73	K ,,	1.97	
N%		Ca ,,	9.0	
P-Olsen (ppm)		Mg ,,	9.0	
		Mn ,,	0.51	
		P (ppm)	18	

Various:

Remarks:

Profile description no. 16

Observation/date : 155-59, Garissa district, Bura East project/7-7-1979
Soil classification : luvic XEROSOL
Mapping unit : Ps 2.7
Parent material : Marine/lacustrine sediments
Physiography : Sedimentary plain
Slope : Less than 0.5%
Vegetation : Cordia sinensis, Sericocomopsis pallida, Chrysopogon aucheri, Tetrapogon tenellus; bushed grassland
Salinity/sodicity : Strongly saline from 75cm and strongly sodic from 28cm onwards
Surface crusting : Strong, 3cm thick
Drainage class : Imperfectly drained

A 0-11cm Dark brown (7.5YR 3/2 moist); sandy clay loam; moderate, medium to coarse, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; few, fine and medium pores; few very fine and common fine roots; pH-H_2O = 6.5; gradual and smooth transition to:
(sample no. 155-59a)

Bt 11-28cm Brown to dark brown (7.5YR 4/4 moist); sandy clay; moderate, coarse prismatic structure breaking into moderate, fine to medium, subangular blocky; firm when moist, sticky and plastic when wet; patchy, thin clay cutans; moderately calcareous; common fine and few coarse pores; common very fine and few fine roots; pH-H_2O = 8.2; gradual and smooth transition to:
(sample no. 155-59b)

Btk 28-75cm Brown (7.5YR 5/2 moist); sandy clay; moderate, very coarse prismatic structure breaking into moderate, medium to coarse, subangular blocky; firm when moist, sticky and plastic when wet; patchy, thin clay cutans; strongly calcareous; pockets of soft powdery lime (5%); few, fine and medium pores; few, very fine to medium roots; pH-H_2O = 8.9; clear and smooth transition to:
(sample no. 155-59c)

Bky 75-192cm Pinkish grey (7.5YR 6/2 moist); clay; weak, fine to medium, subangular blocky structure; friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; pockets of soft powdery lime (5%) and some gypsum crystals; few, very fine to medium pores; few, very fine roots; pH-H_2O = 8.0
(sample nos. 155-59d and e)

C1	192-227cm	Light brownish grey (10YR 6/2); clay; sticky and plastic when wet (sample no. 155-59f)
C2	227-297cm	Grey to light grey (10YR 6/1); clay; sticky and plastic when wet (sample no. 155-59g)
C3	297-346cm	Greyish brown (10YR 5/2); clay; sticky and plastic when wet (sample no. 155-59h)
C4	346-374cm	Greyish brown (10YR 5/2); gravelly clay; sticky and plastic when wet (sample no. 155-59i)

Note: Augered from 160cm downwards.

LABORATORY DATA OF PROFILE DESCRIPTION No: 16

LD OBSERVATION No: 155–59 MAPPING UNIT: Ps 2.7 SOIL CLASSIFICATION: Luvic XEROSOL

aboratory no. ...../79	10206	10207	10208	10209	12840	12841
orizon	A	Bt	Btk	Bky	Bky	C1
epth (cm)	0–11	11–28	28–75	75–150	150–192	192–227
H–H_2O(1: 2½ v/v)	7.8	8.8	9.4	8.6	–	–
H–KCl ..	6.2	7.1	7.7	7.8	–	–
C(mmho/cm) ..	0.18	0.40	0.55	5.5	–	–
aCO_3 (%)	–	–	–	–	4.2	3.8
aSO_4 (%)	tr	tr	tr	tr	–	–
(%)	0.5	0.44	0.36	0.15	–	–
(%)						
/N						
EC (me/100g), pH 8.2	28.8	38.0	40.0	51.4	32.2	33.4
EC .. .. pH 7.0						
xch.Ca (me/100g)	12.4	26.0	28.0	23.0	36.7	18.1
.. Mg ..	6.8	10.8	6.2	5.4	–	–
.. K ..	1.1	1.7	0.7	0.7	0.6	0.3
.. Na ..	1.2	3.6	11.9	24.3	21.1	15.8
Sum of cations	22	42	47	53	–	–
Base sat. %, pH 8.2	75	100+	100+	100+	–	–
.. .. %, pH 7.0						
ESP at pH 8.2	4	10	30	47	66	47
Saturation extract:						
Moisture %	36	66	86	73	81	80
pH–paste	6.5	8.2	8.9	8.0	7.6	7.5
ECe (mmho/cm)	0.50	0.90	4.3	15.5	20.0	23.0
Na (me/l)	1.90	4.00	21.0	105	149	172
K ..	0.48	0.13	0.26	0.38	0.25	0.15
Ca ..	1.70	–	–	22.8	25.5	30.0
Mg ..	1.10	–	–	27.0	25.0	28.3
Sum of cations (me/l)	5.2	–	–	155	199	230
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ..	4.0	3.0	5.0	8.0	7.2	6.9
Cl ..	1.0	4.9	37.0	129	186	214
SO_4 ..	0.31	0.31	0.31	17.4	6.8	8.2
Sum of anions (me/l)	5.3	8.2	42.3	154	200	229
SAR	2	–	–	21	30	–
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X–ray report: A, Bt and Btk horizons: moderately crystallised illite and montmorillonite.

Depth (cm)	0–11	11–28	28–75	75–150	150–192	192–227
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	60	50	52	38	38	36
Silt % 0.05 – 0.002mm	6	4	6	2	2	4
Clay % 0.002 – 0 mm	34	46	42	60	60	60
Texture class	SCL	SC	SC	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30 cm) Laboratory no. 10088 / 79

pH–H_2O (1: 2½ v/v)	7.9	
Exch. acidity (me/100g)	–	
C%	0.38	
N%	–	
P–Olsen (ppm)		

	Available	Total
Na (me/100g)	1.22	
K ..	0.76	
Ca ..	9.8	
Mg ..	7.1	
Mn ..	0.65	
P (ppm)	8	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

LABORATORY DATA OF PROFILE DESCRIPTION No: 16 Continued.

IELD OBSERVATION No: 155-59 MAPPING UNIT: Pu 2.7 SOIL CLASSIFICATION: luvic XEROSOL

Laboratory no. ...../79	12842	12843	12844			
Horizon	C2	C3	C4			
Depth (cm)	227–297	297–346	346–374			
pH–H_2O(1: v/v)	–	–	–			
pH–KCl ..						
EC(mmho/cm) ..	–	–	–			
$CaCO_3$(%)						
$CaSO_4$(%)						
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	37.4	38.2	38.2			
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	14.7	12.5	17.2			
.. Mg ..	–	–	–			
.. K ..	0.3	0.3	0.3			
.. Na ..	15.8	24.4	23.7			
Sum of cations	–	–	–			
Base sat. %, pH 8.2						
.. .. %, pH 7.0	–	–	–			
ESP at pH 8.2	42	64	62			
Saturation extract:						
Moisture %	86	102	91			
pH–paste	7.6	7.6	7.8			
ECe (mmho/cm)	21.0	18.0	17.0			
Na(me/l)	175	161	150			
K ..	0.10	0.03	0.05			
Ca ..	16.5	9.00	9.00			
Mg ..	18.8	11.7	10.8			
Sum of cations(me/l)	210	181	170			
CO_3 (me/l)	0	0	0			
HCO_3 ..	5.2	4.8	8.0			
Cl ..	198	173	160			
SO_4 ..	5.7	3.4	3.8			
Sum of anions(me/l)	209	181	172			
SAR	42	50	48			
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	227–297	297–346	346–374				
Gravel %							
Texture, limited pretreatment:							
Sand % 2.0 – 0.05 mm	34	38	40				
Silt % 0.05–0.002mm	8	10	12				
Clay % 0.002–0 mm	58	52	48				
Texture class	C	C	C				
Dispersed clay %							
Flocculation index							
Texture USDA:							
Sand % 2.0 – 1.0mm							
.. .. 1.0 – 0.50mm							
.. .. 0.50 – 0.25 mm							
.. .. 0.25 – 0.10mm							
.. .. 0.10 – 0.05mm							
Total sand %							
Silt %							
Clay %							
Texture class							
Bulk density							
Moisture % w/v at:							
pF 0							
pF 2.0							
pF 2.3							
pF 2.7							
pF 3.0							
pF 3.7							
pF 4.2							

Fertility aspects: (0– cm) Laboratory no. /

			Available	Total
pH–H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Profile description no. 17

Observation/date : 155-99; Garissa district, Bura East project area/14-12-79
Soil classification : haplic XEROSOL
Mapping unit : Ps 2.8
Parent material : Marine/lacustrine sediments
Physiography : Sedimentary plain
Slope : Less than 0.5%
Vegetation : Dactyloctenium scindicum, Aristida keniensis, Acacia reficiens, Grewia tenax; bushed grassland
Salinity/sodicity : Moderately saline from 60cm and strongly saline from 94cm; strongly sodic from 60cm
Surface sealing : 2-5mm thick, weak
Drainage class : Imperfectly drained

Al 0-20cm Dark greyish brown (10YR 4/2 moist); clay; weak, very fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine and few medium roots; moderate biological activity; pH-H_2O = 8.1; clear and smooth transition to:
(sample no. 155-99a)

Bt 20-60cm Dark grey (10YR 4/1 moist); clay; strong, coarse to very coarse, prismatic structure; very hard when dry, firm when moist, sticky and plastic when wet; few, weak slickensides; strongly calcareous; common, very fine and fine pores; common, very fine and fine roots; moderate biological activity; pH-H_2O = 8.8; clear and smooth transition to:
(sample no. 155-99b)

Btkl 60-94cm Dark greyish brown (10YR 4/2 moist); clay; moderate, medium to coarse, prismatic structure; firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few pockets of soft powdery lime; common, very fine and fine pores; common, very fine roots; no biological activity; pH-H_2O = 8.2; gradual and smooth transition to:
(sample no. 155-99c)

Btk2 94-122cm Dark greyish brown (10YR 4/2 moist); clay; moderate, medium to coarse, angular blocky structure; friable when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few pockets of soft powdery lime; common, very fine and fine pores; pH-H_2O = 8.0; gradual and smooth transition to:
(sample no. 155-99d)

C1	122-199cm	Grey (10YR 5/1 moist); clay; weak, very fine to fine, angular blocky structure; friable when moist, sticky and plastic when wet; no cutans; calcareous; common, very fine and fine pores; no roots observed; pH-H_2O = 8.2 (122-150cm) and 7.8 (150-199) (sample no. 155-99e and f)
C2	199-276cm (augered)	Grey(10YR 5/1 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 7.8 (199-240cm) and 7.6 (240-276cm) (sample no. 155-99g and h)
C3	276-332cm (augered)	like above horizon but non-calcareous; pH-H_2= 7.6 (276-310cm) and 8.0 (310-332cm) (sample no. 155-99 i and j)

LABORATORY DATA OF PROFILE DESCRIPTION No: 17

FIELD OBSERVATION No: 155-99 MAPPING UNIT: Pa 2.8 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ..... /79	15274	15275	15276	15277	15278	15279
Horizon	A	Bt	Btk1	Btk2	C1	C1
Depth (cm)	0-20	20-60	60-94	94-122	122-150	150-199
pH-H_2O (1:2½ v/v)	8.7	8.9	8.8	8.1	8.3	8.0
pH-KCl ,,						
EC (mmho/cm) ,,	0.45	0.65	5.0	9.0	4.5	9.0
$CaCO_3$ (%)						
$CaSO_4$ (%)	0.1	0.1	0.1	0.1	0.1	0.1
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	65.8	61.8	61.8	57.8	57.8	56.2
CEC ,, ,, pH 7.0						
Exch. Ca (me/100g)	44.0	55.5	45.0	74.0	42.0	42.0
,, Mg ,,	7.8	16.8	16.0	12.4	12.0	17.6
,, K ,,	3.3	1.5	1.5	1.2	1.1	1.3
,, Na ,,	1.71	7.1	20.8	23.5	24.2	29.4
Sum of cations	57	81	83	111	79	90
Base sat. %, pH 8.2	86	100+	100+	100+	100+	100+
,, ,, %, pH 7.0						
ESP at pH 8.2	3	12	34	41	42	52
Saturation extract:						
Moisture %	66	91	104	84	129	133
pH-paste	7.7	7.7	7.7	7.5	7.7	7.5
ECe (mmho/cm)	0.55	1.05	9.5	21.5	10.0	22.5
Na (me/l)		5.15	84.0	152	52	173
K ,,		0.23	0.18	0.18	0.36	0.28
Ca ,,		4.50	6.00	30.0	35.5	21.0
Mg ,,		1.17	6.25	31.7	13.5	30.0
Sum of cations (me/l)		11.1	96.4	214	101	224
CO_3 (me/l)		0	0	0	0	0
HCO_3 ,,		2.20	6.00	7.60	6.80	7.60
Cl ,,		9.01	85.0	195	83.5	207
SO_4 ,,		0.70	3.20	10.5	10.5	9.5
Sum of anions (me/l)		11.9	94.2	213	101	224
SAR		3	34	21	11	34
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3 (mmol%)						

X-ray report: A and Bt horizons: Predominantly amorphous material, with traces of very poorly crystallized 2:1 mineral types.

Depth (cm)	0-20	20-60	60-94	94-122	122-150	150-199
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	38	34	30	36	34	26
Silt % 0.05–0.002mm	6	6	8	2	2	6
Clay % 0.002–0 mm	56	60	62	62	64	68
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 30cm)		Laboratory no. 15272/79	Available	Total
pH-H_2O (1:2½ v/v)	8.2		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	1.08	
C%	0.50	K ,,	0.84	
N%	-	Ca ,,	27.0	
P-Olsen (ppm)		Mg ,,	8.0	
		Mn ,,	0.82	
		P (ppm)	26	

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 17 Continued.

FIELD OBSERVATION No: 155-99 MAPPING UNIT: Ps 2.8 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	15280	15281	15282	15283		
Horizon	C2	C2	C3	C3		
Depth (cm)	199-240	240-276	276-310	310-332		
pH-H_2O(1:2½ v/v)	8.0	7.9	7.8	7.8		
pH-KCl ..						
EC(mmho/cm) ..	9.0	9.0	10.0	9.0		
$CaCO_3$(%)						
$CaSO_4$(%)	tr	tr	tr	tr		
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	68.5	65.8	65.8	61.8		
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	17.0	13.6	14.0	13.6		
.. Mg ..	15.6	11.4	16.0	17.2		
.. K ..	0.9	0.9	1.0	1.0		
.. Na ..	28.8	37.0	31.6	32.0		
Sum of cations	62	63	63	64		
Base sat. %, pH 8.2	91	100+	95	100+		
.. .. %, pH 7.0						
ESP at pH 8.2	42	56	48	53		
Saturation extract:						
Moisture %	150	139	132	136		
pH-paste	7.6	7.5	7.4	7.5		
ECe (mmho/cm)	21.0	20.0	21.5	17.0		
Na (me/l)	145	144	179	-		
K ..	0.28	0.28	0.28	-		
Ca ..	34.5	34.5	13.0	-		
Mg ..	31.7	21.7	21.7	-		
Sum of cations(me/l)	211	200	214	-		
CO_3 (me/l)	0	0	0	0		
HCO_3 ..	8.00	7.60	5.6	2.4		
Cl ..	195	186	205	-		
SO_4 ..	5.10	5.10	2.90	-		
Sum of anions(me/l)	208	199	214	-		
SAR	25	27	43	-		
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	199-240	240-276	276-310	310-332		
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	24	24	24	24		
Silt % 0.05-0.002mm	6	8	8	8		
Clay % 0.002-0 mm	70	68	68	68		
Texture class	C	C	C	C		
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0- cm) Laboratory no. /

			Available	Total
pH-H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 18

Observation/date	: 155-100; Garissa district (Bura East project area); 14/12/79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.8
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chloris roxburghiana, Chrysopogon aucheri, Aristida keniensis, Cordia sinensis, Maytenus sp; bushed grassland
Salinity/sodicity	: Moderately saline from 63cm and strongly saline from 89cm; strongly sodic from 17cm
Surface sealing	: 1-3mm thick, strong
Drainage class	: Imperfectly drained

Au1 0-5cm Brown to dark brown (10YR 4/3 moist); clay; porous massive; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; common fine and fine, very few medium roots; moderate biological activity; pH-H_2O = 8.2; abrupt and wavy transition to:

(sample no. 155-100a)

Au2 5-17cm Dark brown (10YR 3/3 moist); clay; weak, fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine and common medium pores; common very fine and fine, very few medium roots; moderate biological activity; pH-H_2O = 8.7; clear and smooth transition to:

(sample no. 155-100b)

Bw 17-63cm Very dark greyish brown (10YR 3/2 moist); clay; moderate, medium to coarse, prismatic structure; very hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; few, very fine and fine pores; few, very fine and fine roots (some dead); pH-H_2O = 8.4; clear and smooth transition to:

(sample no. 155-100c)

Btk 63-89cm Dark brown (10YR 3/3 moist); clay; weak, fine to medium, prismatic structure breaking into moderate, medium to coarse, angular blocky structure; firm when moist, sticky and plastic when wet; patchy, thin clay cutans; strongly calcareous; few pockets of soft powdery lime; few, fine and medium pores; few, very fine and fine roots (some dead); pH-H_2O = 8.0; diffuse and smooth transition to:

(sample no. 155-100d)

Bty1	89-125cm	Brown to dark brown (10YR 4/3 moist); clay; moderate, fine to medium, angular blocky structure; friable when moist, sticky and plastic when wet; broken, thin clay cutans; strongly calcareous; many gypsum crystals (10%); common, fine pores; very few, fine roots (some dead); pH-H_2O = 8.0; diffuse and smooth transition to: (sample no. 155-100e)
Bty2	125-212cm	Brown (10YR 5/3 moist); clay; weak, fine to medium, angular blocky structure; friable when moist, sticky and plastic when wet; broken, thick clay cutans; strongly calcareous; many gypsum crystals (5%); common, fine pores; common, very fine roots; some dead; pH-H_2O = 8.2 (sample no. 155-100g)
C1	212-340cm	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; strongly calcareous; pH-H_2O = 8.2 (sample no. 155-100h and j)
C2	340-363cm	Greyish brown (10YR 5/2 moist); clay; sticky and plastic when wet; strongly calcareous; pH-H_2O = 8.1 (sample no. 155-100k)

Note: Profile was augered from 160cm.

LABORATORY DATA OF PROFILE DESCRIPTION No: 18

ELDOBSERVATION No: 155-100 MAPPING UNIT: Ps 2.8 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no...../79	15284	15285	15286	15287	15288	15289
Horizon	Au1	Au2	Bw	Btk	Bty1	Bty2
Depth (cm)	0-5	5-17	17-63	63-89	89-125	125-168
pH-H_2O(1:2½ v/v)	8.4	8.4	9.1	8.8	8.3	8.4
pH-KCl ,,						
EC(mmho/cm) ,,	0.35	0.35	1.4	4.0	7.5	9.0
$CaCO_3$ (%)						
$CaSO_4$ (%)	0.1	0.3	0.1	0.1	0.1	0.8
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	40.5	35.4	53.5	53.8	50.8	53.7
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	37.6	59.1	42.0	44.0	45.0	44.0
,, Mg ,,	6.6	9.2	12.8	15.2	12.0	15.2
,, K ,,	3.2	2.9	1.4	1.3	0.9	0.9
,, Na ,,	1.5	2.2	15.5	24.1	23.1	25.1
Sum of cations	49	74	72	85	81	85
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
,, ,, %, pH 7.0						
ESP at pH 8.2	3	6	29	45	46	49
Saturation extract:						
Moisture %	34	61	87	81	81	109
pH-paste	8.0	8.0	7.6	7.4	7.7	7.7
ECe (mmho/cm)	1.30	1.05	2.80	12.0	20.0	23.0
Na (me/l)	-	2.78	24.0	60.0	156	190
K ,,	-	0.28	0.23	0.23	0.18	0.23
Ca ,,	-	4.00	2.50	29.0	18.5	21.0
Mg ,,	-	1.67	1.25	30.0	24.2	16.7
Sum of cations(me/l)	-	8.7	28.0	119	199	228
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ,,	3.60	4.80	7.20	5.60	5.20	5.60
Cl ,,	-	6.70	11.5	111	188	220
SO_4 ,,	-	0.20	9.50	5.70	7.10	3.80
Sum of anions(me/l)	-	11.7	28.2	122	200	229
SAR	-	2	18	11	34	44
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3						
Fe_2O_3 (mmol%)						

X-ray report: Au1, Au2 and Bw horizons: Traces of illite and montmorillonite grading into one another.

Depth (cm)	0-5	5-17	17-63	63-89	89-125	125-168
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	44	44	40	38	40	32
Silt % 0.05-0.002mm	8	4	8	8	4	8
Clay % 0.002-0 mm	48	52	52	54	56	60
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30cm) Laboratory no. 15273 / 79

			Available	Total
pH-H_2O (1: 2½ v/v)	8.1		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	-	
C%	0.62	K ,,	1.08	
N%	-	Ca ,,	33.5	
P-Olsen (ppm)		Mg ,,	8.4	
		Mn ,,	0.39	
		P (ppm)	22	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

LABORATORY DATA OF PROFILE DESCRIPTION No: 16 Continued.

FIELD OBSERVATION No: 155-100 MAPPING UNIT: Ps 2.8 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	15290	15291	15292	15293		
Horizon	Bty2	C1	C1	C2		
Depth (cm)	168-212	212-276	276-340	340-364		
$pH-H_2O$ (1: 2½ v/v)	8.4	8.5	8.6	8.5		
pH-KCl ..						
EC (mmho/cm) ..	6.5	7.0	7.0	7.0		
$CaCO_3$ (%)						
$CaSO_4$ (%)	0.7	tr	tr	tr		
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	44.0	35.4	34.6	33.6		
CEC .. .. pH 7.0						
Exch. Ca (me/100g)	61.5	51.5	34.0	32.0		
.. Mg ..	12.4	12.0	14.4	14.0		
.. K ..	0.9	0.9	0.3	0.3		
.. Na ..	24.5	25.1	27.7	28.3		
Sum of cations	99	90	76	85		
Base sat. %, pH 8.2	100+	100+	100+	100+		
.. .. %, pH 7.0						
ESP at pH 8.2	56	71	80	84		
Saturation extract:						
Moisture %	102	112	112	112		
pH-paste	7.6	7.6	8.1	8.0		
ECe (mmho/cm)	14.5	15.5	9.5	16.0		
Na (me/l)	129	136	-	-		
K ..	0.18	0.36	-	-		
Ca ..	6.50	7.50	-	-		
Mg ..	9.17	10.8	-	-		
Sum of cations (me/l)	145	154	-	-		
CO_3 (me/l)	0	0				
HCO_3 ..	4.40	4.80	-	-		
Cl ..	140	146	-	-		
SO_4 ..	3.80	4.30	-	-		
Sum of anions (me/l)	148	154	-	-		
SAR	46	45	-	-		
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report:

Depth (cm)	168-212	212-276	276-340	340-364		
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	38	42	38	38		
Silt % 0.05–0.002 mm	0	6	8	10		
Clay % 0.002–0 mm	62	52	54	52		
Texture class	C	C	C	C		
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0 mm						
.. .. 1.0 – 0.50 mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10 mm						
.. .. 0.10 – 0.05 mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
$pH-H_2O$ (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 19

Observation/date : 155-77; Garissa district; Bura East irrigation project 28/8/78

Soil classification : orthic SOLONETZ

Mapping unit : Ps 2.9

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Chrysopogon aucheri, Sporobolus helvolus, Indigofera schimperi, Combretum hereroense; bushed grassland

Salinity/sodicity : Moderately saline from 40cm and strongly saline from 78cm; strongly sodic from 40cm

Surface sealing : 2mm thick, weak,

Drainage class : Imperfectly drained

A 0-6cm Brown to dark brown (10YR 5/2 dry; 10YR 4/3 moist); clay; massive, breaking into weak, medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous, many very fine, few fine pores; many very fine, common fine and medium roots; pH-H_2O = 8.0; clear and wavy transition to:
(sample no. 155-77a)

AB 6-17cm Very dark greyish brown (10YR 3/2 dry and moist); clay; strong, fine to medium, crumby structure; slightly hard when dry, friable when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; many very fine and fine, few medium pores; many very fine, common fine and medium roots; pH-H_2O = 8.2; clear and wavy transition to:
(sample no. 155-77b)

Btyl 17-78cm Very dark greyish brown (10YR 3/2 dry and moist); clay; strong, very coarse, prismatic structure breaking into weak, fine and medium, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; about 5% gypsum crystals; common very fine and fine, very few medium pores; few, very fine roots; pH-H_2O = 8.8; clear and wavy transition to:
(sample nos. 155-77c and d)

Bty2 78-103cm

Dark greyish brown (10YR 4/2 moist); clay; weak, medium, prismatic structure breaking into moderate, fine and medium, angular and subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few, weak slickensides and broken, thin clayskins; strongly calcareous; about 5% gypsum crystals; common, very fine pores; no roots observed; pH-H_2O = 8.2; clear and smooth transition to:

(sample no. 155-77e)

Cy 103-130cm

Grey (10YR 5/1 moist); clay; moderate, very fine and fine, subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; continuous, strong slickensides; slightly calcareous; about 5% gypsum crystals; common, very fine pores; pH-H_2O = 8.2

(sample no. 155-77f)

LABORATORY DATA OF PROFILE DESCRIPTION No: 19

FIELD OBSERVATION No: 155-77 MAPPING UNIT: Ps 2.9 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12243	12244	12245	12246	12247	12248
Horizon	A	AB	Bty1	Bty	Bty2	Cy
Depth (cm)	0-6	6-17	17-40	40-78	78-103	103-130
pH-H_2O (1: 2½ v/v)	8.3	8.5	8.6	8.2	8.3	8.6
pH-KCl ..						
EC(mmho/cm) ..	0.90	0.40	1.1	4.0	7.5	11.0
$CaCO_3$ (%)	1.2	2.1	1.4	2.2	1.0	1.4
$CaSO_4$ (%)	tr	tr	tr	0.5	1.2	1.0
C (%)	0.62	0.47	0.44	0.36	0.33	0.30
N (%)						
C/N						
CEC (me/100g), pH 8.2	37.0	40.0	40.0	35.0	39.0	47.0
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	34.0	47.0	55.0	53.0	67.0	73.0
.. Mg ..	4.35	5.1	8.6	12.1	16.1	16.5
.. K ..	1.7	0.6	0.6	1.4	1.4	1.0
.. Na ..	0.90	1.0	2.9	12.7	15.8	17.3
Sum of cations	41	54	67	79	100	108
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
.. .. %, pH 7.0						
ESP at pH 8.2	2	3	7	36	41	37
Saturation extract:						
Moisture %	–	–	73	85	97	113
pH-paste	7.7	7.4	7.2	7.0	7.1	7.3
ECe (mmho/cm)	0.70	0.45	1.4	8.5	19.0	19.0
Na (me/l)	2.00	1.85	8.0	54.0	140	143
K ..	0.36	0.18	0.8	0.08	0.28	0.36
Ca ..	5.50	3.00	4.00	20.0	24.0	23.5
Mg ..	1.25	0.83	1.25	10.4	25.0	22.5
Sum of cations (me/l)	9.1	5.9	14.1	84	189	189
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ..	1.60	2.40	4.00	12.0	26.0	16.0
Cl ..	5.60	1.50	6.00	62.0	151	161
SO_4 ..	0.94	0.94	1.88	9.90	11.8	10.8
Sum of anions (me/l)	8.1	4.8	11.9	84	189	188
SAR	1	1	5	14	28	30
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report:

Depth (cm)	0-6	6-17	17-40	40-78	78-103	103-130
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	42	40	36	38	30	24
Silt % 0.05–0.002 mm	10	14	12	6	16	8
Clay % 0.002–0 mm	48	46	52	56	54	68
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0 mm						
.. .. 1.0 – 0.50 mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10 mm						
.. .. 0.10 – 0.05 mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at-						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30 cm) Laboratory no. 12256 / 79

			Available	Total
pH-H_2O (1:2½ v/v)	8.2		Available	Total
Exch. acidity (me/100g)	–	Na (me/100g)	1.84	
C%	0.56	K ..	0.21	
N%		Ca ..	26.5	
P-Olsen (ppm)		Mg ..	6.2	
		Mn ..	0.32	
		P (ppm)	25	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 7050

Profile description no. 20

Observation/date	: 155-80; Garissa district; Bura East irrigation project 8/9/79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 2.9
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Sporobolus helvolus, Grewia tenax, Sterculia rynchocarpa; bushed grassland
Salinity/sodicity	: Strongly saline and strongly sodic from 35cm
Surface sealing	: 5mm thick, weak
Drainage class	: Imperfectly drained
A 0-7cm	Dark greyish brown (10YR 5/2 dry, 10YR 4/2 moist); sandy clay; moderate, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; many, very fine and fine pores; many very fine and fine, few medium roots; pH-H_2O = 7.7; clear and smooth transition to: (sample no. 155-80a)
BA 7-35cm	Dark brown to brown (10YR 4/3 moist); clay; weak, medium to coarse, prismatic structure breaking into moderate, medium to coarse subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; many, very fine and fine pores; many, very fine and fine roots; pH-H_2O = 8.6; clear and smooth transition to: (sample no. 155-80b)
Btk 35-55cm	Dark brown to brown (10YR 4/3 moist); clay; moderate, fine and medium, subangular blocky structure, hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few pockets of soft powdery lime; common, very fine and fine pores; common very fine, few medium roots; pH-H_2O = 7.9; clear and smooth transition to: (sample no. 155-80c)

Btky 55-100cm	Dark brown to brown (10YR 4/3 moist); clay; weak, medium, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; pockets of soft powdery lime, pseudo mycelium and about 10% gypsum crystals; common, very fine and fine pores; very few, very fine dead roots; pH-H_2O = 8.0; clear and smooth transition to: (sample no. 155-80d)
BCky 100-171cm	Greyish brown (10YR 5/2 moist); clay; weak, very fine, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; patchy, thin slickensides; calcareous; pockets of soft powdery lime (5%) and about 30% gypsum crystals; common, very fine and fine pores; very few, very fine (dead) roots; pH-H_2O = 8.0 (sample nos. 155-80e and f)
C 171-211cm (augered)	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; non-calcareous; pH-H_2O = 8.0 (sample no. 155-80g)

Note: The Btky horizon is very compact.

LABORATORY DATA OF PROFILE DESCRIPTION No: 20

OBSERVATION No: 155-80 MAPPING UNIT: Pe 2.9 SOIL CLASSIFICATION: orthic SOLONETZ

oratory no. . . . . ./79	12933	12934	12935	12936	12937	12938
izon	A	BA	Btk	Btky	BCky	BCky
th (cm)	0-7	7-35	35-55	55-100	100-120	120-171
-H_2O(1:2½ v/v)	7.9	8.2	8.0	8.2	8.2	8.1
-KCl ,,						
(mmho/cm) ,,	0.40	2.7	7.5	5.5	7.5	8.0
CO_3 (%)	0.6	1.8	2.1	1.9	4.2	1.6
SO_4 (%)	tr	tr	tr	0.1	0.1	0.4
%)						
%)						
N						
C (me/100g), pH 8.2	33.1	48.2	51.4	43.0	46.6	48.2
C ,, ,, pH 7.0						
ch.Ca (me/100g)	15.9	29.7	16.2	22.2	15.7	14.7
Mg ,,	2.8	-	-	-	-	-
K ,,	1.7	0.4	0.4	0.5	0.4	0.4
Na ,,	2.6	5.0	13.3	17.2	21.8	21.1
n of cations	23	-	-	-	-	-
se sat. %, pH 8.2	69	-	-	-	-	-
,, %, pH 7.0						
P at pH 8.2	8	10	26	40	47	44
aturation extract:						
isture %	90	49	81	107	123	125
-paste	8.0	7.6	7.3	7.4	7.3	7.6
e (mmho/cm)	0.95	3.5	20.5	24.0	21.0	21.5
(me/l)	6.20	34.0	143	170	150	155
,,	0.35	0.18	0.28	0.38	0.38	0.28
,,	1.50	2.3	35.0	34.5	34.0	34.0
,,	1.04	4.17	27.3	33.3	25.6	26.5
n of cations(me/l)	9.1	40.7	206	238	210	216
$_3$(me/l)	0	0	0	0	0	0
O_3 ,,	7.99	6.66	7.99	7.33	7.33	6.66
,,	1.50	37.0	191	226	196	195
,,	0.30	0.60	6.30	6.70	6.70	13.1
n of anions(me/l)	9.8	44.3	205	240	210	215
SAR	6	19	26	29	27	28
lay mineralogy:						
$_2/Al_2O_3$(mol/mol)						
$_2/R_2O_3$,,						
O_3(mmol%)						
ay report:						

Depth (cm)	0-7	7-35	35-55	55-100	100-120	120-171
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	46	36	28	42	34	34
Silt % 0.05–0.002mm	8	6	4	8	4	2
Clay % 0.002–0 mm	46	58	68	50	62	64
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30cm)		Laboratory no. 12730 / 79	Available	Total
$pH-H_2O$ (1: 2½v/v)	7.7		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	4.56	
C%	0.62	K ,,	0.34	
N%	-	Ca ,,	19.0	
P–Olsen (ppm)		Mg ,,	7.6	
		Mn ,,	0.44	
		P (ppm)	16	

Various.

Remarks:

Kenya Soil Survey
Drawing No. 79050

1-69

LABORATORY DATA OF PROFILE DESCRIPTION No: 20 Continued.

OBSERVATION No:155-80 MAPPING UNIT: Fs 2.9 SOIL CLASSIFICATION: orthic SOLONETZ

ratory no. ..... /79	12939					
zon	C					
th (cm)	171-211					
H_2O(1:2½ v/v)	8.1					
KCl ..						
mmho/cm) ..	8.0					
O_3 (%)	1.4					
O_4(%)	0.8					
)						
)						
C (me/100g), pH 8.2	60.6					
C .. .. pH 7.0						
h.Ca (me/100g)	8.6					
Mg ..	-					
K ..	0.5					
Na ..	21.4					
of cations	-					
e sat. %, pH 8.2	-					
.. %, pH 7.0						
at pH 8.2	35					
turation extract:						
sture %	124					
-paste	7.7					
(mmho/cm)	16.5					
me/l)	140					
..	0.18					
..	12.3					
..	12.5					
of cations(me/l)	165					
(me/l)	0					
O_3 ..	9.99					
..	148					
..	7.30					
of anions(me/l)	165					
SAR	40					
ay mineralogy:						
/Al_2O_3(mol/mol)						
/R_2O_3 ..						
O_3(mmol%)						
ay report:						

Depth (cm)	171-211					
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	26					
Silt % 0.05–0.002mm	8					
Clay % 0.002–0 mm	66					
Texture class	C					
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH–H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 21

Observation/date : 155-83; Garissa district; Bura East project area; 12/9/79

Soil classification : orthic SOLONETZ

Mapping unit : Ps 2.9

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Schoenefeldia transiens, Chrysopogon aucheri, Dobera glabra, Grewia tenax; bushed grassland

Salinity/sodicity : Moderately saline from 45cm and strongly saline from 78cm; strongly sodic from about 30cm

Surface sealing : 3mm thick, moderate

Drainage class : Imperfectly drained

A 0-7cm Very dark greyish brown (10YR 4/2 dry, 10YR 3/2 moist); sandy clay; weak, very fine, crumby and weak, very fine and fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; no cutans observed; calcareous; many, very fine pores; common, very fine, fine and medium roots; pH-H_2O = 8.1; clear and wavy transition to:
(sample no. 155-83a)

Bt 7-45cm Dark grey (10YR 4/1 dry and moist); common, medium, distinct, grey mottles; clay; moderate, coarse to very coarse, prismatic structure breaking into weak, coarse subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; calcareous; few, very fine pores; few, very fine, fine and medium roots; pH-H_2O = 9.2; gradual and smooth transition to:
(sample no. 155-83b)

Btk 45-78cm Very dark grey (10YR 3/1 moist); few, fine, faint, grey mottles; clay; weak, coarse, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet;broken, moderately thick clayskins; strongly calcareous; few pockets of soft powdery lime (2 %); few, very fine pores; few, very fine roots; pH-H_2O = 8.5; diffuse and wavy transition to:
(sample no. 155-83c)

Btky 78-100cm Dark grey (10YR 4/1 moist); clay; moderate, medium to coarse, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; few pockets of soft powdery lime (2%) and about 2% gypsum crystals; few, very fine pores; few, very fine dead roots; pH-H_2O = 8.0; diffuse and wavy transition to:
(sample no. 155-83d)

BCyz	100-133cm	Grey (10YR 5/1 moist); clay; weak, coarse to very coarse, angular blocky structure; firm when moist, sticky and plastic when wet; patchy, thin slickensides; strongly calcareous; about 3% gypsum crystals and salt crystals; few, very fine pores; very few (dead) roots; pH-H_2O = 8.0; (sample no. 155-83e)
C	133-223cm (augered)	Grey (10YR 5/1); clay; sticky and plastic when wet; calcareous; pH-H_2O = 8.2; (sample no. 155-83f, g and h)

Notes: 1) 1 cm wide crakcs from surface to 2nd horizon.

2) prism sides have a thin layer of coarse sand.

LABORATORY DATA OF PROFILE DESCRIPTION No: 21

FIELD OBSERVATION No: 155-83 MAPPING UNIT: Ps 2.9 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12903	12904	12905	12906	12907	12908
Horizon	A	Bt	Btk	Btky	BCys	C
Depth (cm)	0-7	7-45	45-78	78-100	100-133	133-160
pH-H_2O(1:2½ v/v)	8.4	9.0	8.1	8.3	8.3	8.5
pH-KCl ..						
EC(mmho/cm) ..	0.4	0.4	4.5	5.5	5.0	5.5
$CaCO_3$(%)	0.9	2.1	2.1	2.2	2.1	2.6
$CaSO_4$(%)	tr	tr	tr	tr	0.4	0.2
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	23.0	29.6	38.2	38.2	33.4	48.2
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	39.8	46.0	21.2	17.2	39.7	24.9
.. Mg ..	1.3	1.7	–	–	–	–
.. K ..	1.5	0.8	0.7	0.4	0.4	0.2
.. Na ..	1.4	5.2	12.6	12.6	9.6	16.3
Sum of cations	44	54	–	–	–	–
Base sat. %, pH 8.2	100+	100+	–	–	–	–
.. .. %, pH 7.0						
ESP at pH 8.2	6	18	33	33	29	34
Saturation extract:						
Moisture %	26	80	47	88	82	35
pH-paste	7.5	7.5	7.6	7.4	7.5	7.6
ECe (mmho/cm)	1.3	1.7	14.0	17.0	16.0	15.0
Na(me/l)			108	100	120	117
K ..			0.24	0.24	0.22	0.23
Ca ..			20.0	34.5	31.0	20.5
Mg ..			11.25	34.5	18.3	12.5
Sum of cations(me/l)			139	169	170	150
CO_3(me/l)			0	0	0	0
HCO_3 ..			6.95	6.00	10.0	10.0
Cl ..			119	150	140	135
SO_4 ..			6.60	13.2	10.3	5.6
Sum of anions(me/l)			133	169	160	151
SAR			27	17	24	29
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	0-7	7-45	45-78	78-100	100-133	133-160
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	48	42	38	40	38	42
Silt % 0.05–0.002mm	10	10	4	2	4	4
Clay % 0.002–0 mm	42	48	58	58	58	54
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen(ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 21 Continued.

FIELD OBSERVATION No: 155-83 MAPPING UNIT: Ps 2.9 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12909	12910				
Horizon	C	C				
Depth (cm)	160-193	193-223				
pH-H_2O(1:2½ v/v)	8.4	8.7				
pH-KCl ,,						
EC(mmho/cm) ,,	5.0	4.0				
$CaCO_3$(%)	2.7	1.8				
$CaSO_4$(%)	1.2	1.4				
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	33.4	41.4				
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	14.7	24.7				
,, Mg ,,	–	–				
,, K ,,	0.7	0.9				
,, Na ,,	5.0	10.1				
Sum of cations						
Base sat. %, pH 8.2						
,, ,, %, pH 7.0						
ESP at pH 8.2	15	24				
Saturation extract:						
Moisture %	82	96				
pH-paste	7.6	7.7				
ECe (mmho/cm)	16.5	13.5				
Na (me/l)	125	116				
K ,,	0.24	0.18				
Ca ,,	23.5	11.5				
Mg ,,	15.0	7.50				
Sum of cations(me/l)	164	135				
CO_3(me/l)	0	0				
HCO_3 ,,	7.76	8.32				
Cl ,,	150	119				
SO_4 ,,	6.6	3.8				
Sum of anions(me/l)	164	131				
SAR	28	38				
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	160-193	193-223				
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	42	32				
Silt % 0.05–0.002mm	4	10				
Clay % 0.002–0 mm	54	58				
Texture class	C	C				
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH-H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ,,		
N%		Ca ,,		
P-Olsen(ppm)		Mg ,,		
		Mn ,,		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 22

Observation/date	: 155-86; Garissa district; Bura East project area; 10/9/79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 2.9
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Schoenefeldia transiens, Combretum hereroense, Grewia tenax; bushed grassland
Salinity/sodicity	: Moderately saline from 40cm and strongly saline from 60cm; strongly sodic from 40cm
Surface sealing	: 1-2mm
Drainage class	: Imperfectly drained

A 0-10cm Dark brown to brown (10YR 3/3 dry, 10YR 4/3 moist); sandy clay loam; moderate, very fine and fine, crumby structure and weak, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; many, very fine and fine pores; many very fine and fine, few medium roots; pH-H_2O = 7.4; clear and wavy transition to:
(sample no. 155-86a)

Bt 10-40cm Dark brown to brown (10YR 4/3 moist); sandy clay; moderate, medium to coarse, prismatic structure breaking into weak, medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; calcareous; common, very fine and fine pores; common very fine and fine, few medium and coarse roots; pH-H_2O = 9.4; clear and smooth transition to:
(sample no. 155-86b)

Btk 40-60cm Dark brown (10YR 3/3 moist); clay; weak, coarse to very coarse, prismatic structure; firm when moist, sticky and plastic when wet; broken, moderately thick clay cutans; strongly calcareous; lime lycelium; many very fine and fine, few medium pores; very few, very fine and fine (dead) roots; pH-H_2O = 8.4; clear and smooth transition to:
(sample no. 155-86c)

BCz	60-95cm	Very dark greyish brown (10YR 3/2 moist); clay; moderate, fine and medium, angular blocky structure; firm when moist, sticky and plastic when wet; no cutans observed; many salt crystals; strongly calcareous; common, very fine pores; very few, very fine (dead) roots; pH-H_2O = 8.0; (sample no. 155-86d)
Cz1	95-174cm	Dark greyish brown (10YR 4/2 moist); clay; moderate, very fine and fine, angular blocky structure; firm when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; many salt crystals; common, very fine pores; no roots observed; pH-H_2O = 8.2; (sample no. 155-86e)
Cz2	174-232cm (augered)	Greyish brown (10YR 5/2 moist); clay; sticky and plastic when wet; strongly calcareous; many salt crystals; pH-H_2O = 8.0 (sample no. 155-86f)

LABORATORY DATA OF PROFILE DESCRIPTION No: 22

LD OBSERVATION No: 155-86 MAPPING UNIT: Ps 2.9

SOIL CLASSIFICATION: orthic SOLONETZ

aboratory no. .....√79	12956	12957	12958	12959	12960	12961
lorizon	A	Bt	Btk	BCs	Cs1	Cs2
epth (cm)	0-10	10-40	40-60	60-95	95-174	174-232
H-H_2O(1:2½ v/v)	7.7	9.0	8.5	8.2	8.5	8.4
H-KCl ..						
C (mmho/cm) ..	0.40	0.65	4.5	6.5	4.0	6.0
aCO_3 (%)	0.9	3.9	4.0	3.8	2.3	4.5
aSO_4 (%)	0.1	0.1	0.1	0.1	0.2	0.1
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	18.4	37.0	32.6	30.2	27.0	
EC .. .. pH 7.0						
xch.Ca (me/100g)	21.2	36.8	14.0	14.7	16.2	
.. Mg ..	2.0	16.8	–	–	–	
.. K ..	1.5	0.6	0.4	0.6	0.5	
.. Na ..	0.6	5.8	8.3	10.1	9.1	
um of cations	25	60	–	–	–	
ase sat. %, pH 8.2	100+	100+	–	–	–	
.. .. %, pH 7.0						
SP at pH 8.2	3	14	25	33	33	
Saturation extract:						
oisture %	49	67	72	79	88	127
H-paste	7.6	7.7	7.6	7.6	7.7	7.5
Ce (mmho/cm)	0.90	0.90	13.5	17.0	12.5	16.0
a (me/l)	3.00	–	90.0	114	120	119
..	0.18	–	0.13	0.28	0.22	0.18
a ..	4.50	–	23.5	31.3	13.3	24.5
g ..	1.88	–	24.0	26.0	10.4	17.1
um of cations (me/l)	9.6	–	138	171	144	161
O_3 (me/l)	0	0	0	0	0	–
CO_3 ..	7.33	4.66	9.99	6.66	6.66	5.99
..	1.60	–	117	150	108	141
O_4 ..	1.00	–	8.30	14.0	8.3	13.1
um of anions (me/l)	9.9	–	135	171	123	160
SAR	2	–	18	21	35	26
Clay mineralogy:						
O_2/Al_2O_3 (mol/mol)						
O_2/R_2O_3 ..						
e_2O_3 (mmol%)						
-ray report:						

Depth (cm)	0-10	10-40	40-60	60-95	95-174	174-232
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	62	50	44	40	40	38
Silt % 0.05–0.002mm	8	8	8	2	8	10
Clay % 0.002–0 mm	30	42	48	58	52	52
Texture class	SCL	SC	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30cm) Laboratory no. 12726 / 79

			Available	Total
pH-H_2O (1:2½ v/v)	7.9		Available	Total
Exch. acidity (me/100g)	–	Na (me/100g)	1.80	
C%	0.77	K ..	0.34	
N%	–	Ca ..	23.9	
P-Olsen (ppm)		Mg ..	7.4	
		Mn ..	0.64	
		P (ppm)	16	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 23

Observation/date : 155-81; Garissa district; Bura East project area; 8/9/79

Soil classification : orthic SOLONETZ

Mapping unit : Ps 2.10

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Schoenefeldia transiens, Chrysopogon aucheri, Combretum hereroense, Grewia tenax; bushed grassland

Salinity/sodicity : Strongly saline from 42cm and strongly sodic from 10cm

Surface sealing : 2-5mm thick, moderate

Drainage class : Imperfectly drained

A 0-10cm Dark grey (10YR 5/1 dry, 10YR 4/1 moist); sandy clay; moderate, very fine and fine, crumby structure; hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine and fine, few medium pores; common, very fine and fine roots; pH-H_2O = 8.3; clear and smooth transition to:
(sample no. 155-81a)

Bt1 10-44cm Dark greyish brown (10YR 4/1 dry, 10YR 4/2 moist); clay; moderate, coarse to very coarse, prismatic structure, breaking into moderate, very fine and fine, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; weak lime pseudo mycelium; few, very fine and fine pores; common very fine, very few medium roots; pH-H_2O = 8.7; clear and smooth transition to:
(sample no. 155-81b)

Bt2 42-75cm Dark greyish brown (10YR 4/2 moist); clay; moderate, fine to medium, subangular blocky to moderate, fine, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins and common, moderate slickensides; strongly calcareous; few, very fine to medium pores; common very fine, very few medium roots; pH-H_2O = 8.3; clear and smooth transition to:
(sample no. 155-81c)

Bky	75-112cm	Dark greyish brown (10YR 4/2 moist); clay; weak, fine, subangular blocky structure; friable when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; strong lime pseudo mycelium and about 3% gypsum crystals; many, very fine and fine pores; very few, fine, dead roots; pH-H_2O = 7.9; diffuse and smooth transition to: (sample no. 155-81d)
BCz	112-173cm	Greyish brown (10YR 5/2 moist); clay; moderate, very fine, angular blocky structure; friable when moist; sticky and plastic when wet; few, weak slickensides; strongly calcareous; many salt crystals; many, very fine and fine pores; pH-H_2O = 8.0 (sample nos. 155-81e and f)
C	117-229cm (augered)	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; strongly calcareous; pH-H_2O = 7.9 (sample no. 155-81g)

Note: Cracks extend into the Bt2 horizon and are partly filled up with sandy material from the topsoil.

LABORATORY DATA OF PROFILE DESCRIPTION No: 23

FIELD OBSERVATION No: 155-81 MAPPING UNIT: Pe 2.10 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no...../79	12940	12941	12942	12943	12944	12945
Horizon	A	Bt1	Bt2	Bky	BCs	BCs
Depth (cm)	0-10	10-42	42-75	75-112	112-133	133-173
pH-H_2O(1: $2\frac{1}{2}$ v/v)	8.2	9.2	9.0	8.2	8.2	8.2
pH-KCl ..						
EC(mmho/cm) ..	0.60	1.2	6.0	6.0	7.5	8.5
$CaCO_3$(%)	0.9	4.0	4.0	3.9	1.6	1.5
$CaSO_4$(%)	tr	tr	tr	0.4	0.6	tr
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	41.5	38.2	39.6	38.2	48.2	53.4
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	49.0	4.9	10.6	11.5	4.9	4.0
.. Mg ..	1.6					
.. K ..	2.4	0.8	0.9	0.7	0.5	0.4
.. Na ..	1.3	7.3	7.7	10.3	18.7	18.0
Sum of cations	64					
Base sat. %, pH 8.2	100+	-	-	-	-	-
.. .. %, pH 7.0						
ESP at pH 8.2	3	19	22	27	39	34
Saturation extract:						
Moisture %	40	113	92	60	76	66
pH-paste	7.7	8.3	7.7	7.7	7.6	7.6
ECe (mmho/cm)	1.10	2.10	15.0	20.0	24.0	24.5
Na (me/l)	4.05	19.5	125	137	174	175
K ..	0.23	0.42	0.28	0.28	0.18	0.13
Ca ..	5.00	1.50	16.0	33.5	34.5	35.0
Mg ..	1.46	0.63	18.5	29.6	31.7	32.5
Sum of cations(me/l)	10.7	21.8	160	200	240	243
CO_3(me/l)	0	0	0	0	0	0
HCO_3 ..	5.99	5.33	9.99	8.66	7.99	9.99
Cl ..	5.00	15.0	137	180	215	225
SO_4 ..	0.60	0.30	3.90	11.9	17.8	8.80
Sum of anions(me/l)	11.6	20.6	151	201	241	244
SAR	2	19	30	24	30	30
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report: A and Bt1 horizons: Mainly montmorillonite, with some poorly crystallized illite.

Depth (cm)	0-10	10-42	42-75	75-112	112-133	133-173
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	46	42	30	38	36	30
Silt % 0.05-0.002mm	10	6	10	2	2	2
Clay % 0.002-0 mm	44	52	60	60	62	68
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25 mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30cm) Laboratory no. 12734 / 79

			Available	Total
pH-H_2O (1: $2\frac{1}{2}$v/v)	8.1			
Exch. acidity (me/100g)	-	Na (me/100g)	1.18	
C%	0.89	K ..	0.75	
N%	-	Ca ..	23.9	
P-Olsen (ppm)		Mg ..	7.6	
		Mn ..	0.66	
		P (ppm)	12	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

LABORATORY DATA OF PROFILE DESCRIPTION No:23 Continued.

LDOBSERVATION No: 155-81 MAPPING UNIT: Ps 2.10 SOIL CLASSIFICATION: orthic SOLONETZ

aboratory no. ...../79	12946					
orizon	C					
epth (cm)	173–230					
H-H_2O(1: 2½ v/v)	8.3					
H-KCl ..						
C(mmho/cm) ..	7.0					
aCO_3 (%)	4.1					
aSO_4(%)	tr					
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	48.6					
EC .. .. pH 7.0						
xch.Ca (me/100g)	4.9					
.. Mg ..						
.. K ..	0.9					
.. Na ..	20.3					
um of cations						
ase sat. %, pH 8.2	–					
.. .. %, pH 7.0						
SP at pH 8.2	71					
Saturation extract:						
oisture %	155					
H–paste	7.6					
Ce (mmho/cm)	23.0					
a (me/l)	220					
..	0.18					
a ..	30.8					
g ..	28.9					
um of cations(me/l)	280					
O_3(me/l)	0					
CO_3 ..	9.99					
..	260					
4 ..	10.9					
n of anions(me/l)	281					
SAR	40					
Clay mineralogy:						
$_2$/Al_2O_3(mol/mol)						
$_2$/R_2O_3 ..						
$_2O_3$(mmol%)						
ray report:						

Depth (cm)	173–230					
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	28					
Silt % 0.05–0.002mm	2					
Clay % 0.002–0 mm	68					
Texture class	C					
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /		
pH-H_2O (1: v/v)			Available	Total
Exch.acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen(ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No 7985a

Profile description no. 24

Observation/date	: 155-84; Garissa district; Bura East irrigation project; 12/9/79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 2.10
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Sporobolus helvolus, Schoenefeldia transiens, Combretum hereroense; bushed grassland
Salinity/sodicity	: Moderately saline from 40cm and strongly saline from 60cm ; strongly sodic from 10 cm
Surface sealing	: 5mm thick, weak
Drainage class	: Imperfectly drained

A 0-10cm Very dark greyish brown (10YR 2/2 dry, 10YR 3/2 moist); sandy clay; moderate, very fine and fine, crumby structure; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; many, very fine and fine pores; many, very fine and fine roots; pH-H_2O = 7.6; clear and smooth transition to:

(sample no. 155-84a)

Bt 10-40cm Dark greyish brown (10YR 4/2 moist); clay; moderate, coarse to very coarse, prismatic structure; hard when dry, firm when moist; sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; common, very fine, pores; common very fine and fine, few medium roots; pH-H_2O = 8.0; gradual and smooth transition to:

(sample no. 155-84b)

Btk1 40-60cm Dark yellowish brown (10YR 4/4 moist); clay; moderate, medium to coarse, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; some pockets of soft lime (3%); many very fine and fine pores; common, very fine and fine roots; pH-H_2O = 8.5; clear and smooth transition to:

(sample no. 155-84c)

Btk2 60-84cm Dark brown (10YR 3/3 moist); clay; moderate to strong, fine and medium, angular blocky structure; firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; strong lime pseudo mycelium; many, very fine and fine pores; very few, very fine and fine roots; pH-H_2O = 8.2; gradual and smooth transition to:

(sample no. 155-84d)

BCkz	84-120cm	Dark greyish brown (10YR 4/2 moist); clay; strong, very fine and fine, angular blocky structure; firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few pockets of soft powdery lime (1%) and salt crystals; many, very fine and fine pores; very few, very fine, dead roots; pH-H_2O = 8.2; gradual and smooth transition to: (sample no. 155-84e)
Ck	120-141cm	Greyish brown (10YR 5/2 moist); clay; strong, fine and medium, angular blocky structure; friable to firm when moist, sticky and plastic when wet; many, strong slickensides; strongly calcareous; few pockets of soft powdery lime (2%); many very fine and fine pores; no roots observed; pH-H_2O = 8.2; gradual and smooth transition to: (sample no. 155-84f)
Cyz	141-221cm	Greyish brown (10YR 5/2 moist); clay; weak, very fine and fine angular blocky structure; friable when moist, sticky and plastic when wet; common, weak slickensides; strongly calcareous; about 30% (?) gypsum and salt crystals; no roots observed; pH-H_2O = 8.2; gradual and wavy transition to: (sample no. 155-84g and h)
C	221-263cm (augered)	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; calcareous; pH-H_2O = 8.3

Note: 1-2cm wide crakcs extend into the Btk1 horizon and are partly filled up with sandy material from the topsoil.

LABORATORY DATA OF PROFILE DESCRIPTION No: 24

ELD OBSERVATION No: 155-84 MAPPING UNIT: Ps 2.10 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12947	12948	12949	12950	12951	12952
Horizon	A	Bt	Btk1	Btk2	BCk2	Ck
Depth (cm)	0-10	10-40	40-60	60-84	84-120	120-141
pH-H_2O(1:2½ v/v)	8.4	9.1	8.4	8.3	8.2	8.6
pH-KCl ..						
EC(mmho/cm) ..	0.6	0.7	3.0	6.5	9.0	7.0
$CaCO_3$ (%)	2.0	3.4	3.4	3.8	4.0	4.1
$CaSO_4$ (%)	tr	tr	tr	tr	tr	tr
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	31.5	41.4	44.6	44.6	39.8	44.6
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	52.0	10.6	12.5	9.6	8.7	4.0
.. Mg ..	1.3					
.. K ..	1.6	1.3	0.9	1.5	0.7	0.9
.. Na ..	2.4	10.7	20.2	23.4	21.8	23.4
Sum of cations	57					
Base sat. %, pH 8.2	100+	-	-	-	-	-
.. .. %, pH 7.0						
ESP at pH 8.2	8	26	45	52	55	52
Saturation extract:						
Moisture %	44	54	68	57	73	77
pH-paste	7.8	8.3	7.9	7.6	7.7	7.5
ECe (mmho/cm)	1.40	0.85	9.0	22.0	21.0	21.0
Na (me/l)	7.00	5.00	80.0	160	153	170
K ..	0.13	0.18	0.28	0.18	0.23	0.13
Ca ..	5.00	2.00	4.50	28.0	28.0	19.3
Mg ..	1.88	1.04	4.79	33.3	29.0	21.5
Sum of cations(me/l)	14.0	8.2	89.6	221	210	211
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ..	9.99	4.99	6.66	7.99	6.66	6.66
Cl ..	3.00	3.50	81.0	200	192	196
SO_4 ..	1.60	0.60	2.70	13.0	11.0	7.80
Sum of anions(me/l)	14.6	9.1	90.4	221	210	210
SAR	4	4	37	29	29	38
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report: A, Bt and Btk1 horizons: Mainly montmorillonite, with traces of illite.

Depth (cm)	0-10	10-40	40-60	60-84	84-120	120-141
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	46	46	38	34	34	34
Silt % 0.05-0.002mm	6	6	10	2	2	6
Clay % 0.002-0 mm	48	48	52	64	64	60
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30 cm) Laboratory no. 12736/ 79

			Available	Total
pH-H_2O (1: 2½ v/v)	7.5		Available	Total
Exch. acidity (me/100g)		Na (me/100g)	1.01	
C%	0.89	K ..	0.75	
N%		Ca ..	9.2	
P-Olsen (ppm)		Mg ..	6.2	
		Mn ..	0.74	
		P (ppm)	12	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

LABORATORY DATA OF PROFILE DESCRIPTION No: 24 Continued

FIELD OBSERVATION No: 155-84 MAPPING UNIT: Ps 2.10 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12953	12954	12955
Horizon	Cys	Cys	C
Depth (cm)	141–165	165–221	221–263
pH–H_2O(1:2½ v/v)	8.1	8.5	8.8
pH–KCl ..			
EC(mmho/cm) ..	7.0	8.0	5.0
$CaCO_3$(%)	3.2	3.8	0.9
$CaSO_4$(%)	tr	1.7	1.2
C (%)			
N (%)			
C/N			
CEC (me/100g), pH 8.2	48.2	45.5	46.6
CEC .. .. pH 7.0			
Exch.Ca (me/100g)	4.9	4.0	5.7
.. Mg ..			
.. K ..	1.2	1.0	0.7
.. Na ..	23.4	21.4	23.7
Sum of cations			
Base sat. %, pH 8.2	–	–	–
.. .. %, pH 7.0			
ESP at pH 8.2	49	47	51
Saturation extract:			
Moisture %	90	126	138
pH–paste	7.1	7.6	7.6
ECe (mmho/cm)	20.5	17.5	12.5
Na (me/l)	155	145	110
K ..	0.18	0.28	0.38
Ca ..	27.0	13.5	7.00
Mg ..	23.5	16.7	0.33
Sum of cations(me/l)	206	175	126
CO_3 (me/l)	0	0	0
HCO_3 ..	7.33	5.33	7.33
Cl ..	187	166	113
SO_4 ..	11.4	3.20	3.90
Sum of anions(me/l)	206	175	124
SAR	31	37	40
Clay mineralogy:			
SiO_2/Al_2O_3(mol/mol)			
SiO_2/R_2O_3 ..			
Fe_2O_3(mmol%)			

X–ray report:

Depth (cm)	141–165	165–221	221–263
Gravel %			
Texture, limited pretreatment:			
Sand % 2.0 – 0.05 mm	36	30	30
Silt % 0.05–0.002mm	6	8	10
Clay % 0.002–0 mm	58	62	60
Texture class	C	C	C
Dispersed clay %			
Flocculation index			
Texture USDA:			
Sand % 2.0 – 1.0mm			
.. .. 1.0 – 0.50mm			
.. .. 0.50 – 0.25 mm			
.. .. 0.25 – 0.10mm			
.. .. 0.10 – 0.05mm			
Total sand %			
Silt %			
Clay %			
Texture class			
Bulk density			
Moisture % w/v at:			
pF 0			
pF 2.0			
pF 2.3			
pF 2.7			
pF 3.0			
pF 3.7			
pF 4.2			

Fertility aspects: (0– cm) Laboratory no. /

			Available	Total
pH–H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Profile description no. 25

Observation/date	: 155-56, Garissa District, Bura East project /10-4-79
Soil classification	: luvic XEROSOL
Mapping unit	: Ps 2.11
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Chloris roxburghiana, Indigofera schimperi, Grewia tenax; bushed grassland
Salinity/sodicity	: Strongly saline from 39cm and moderately sodic from 15cm
Surface sealing	: Very weak, 2-5mm
Drainage class	: Poorly drained

A 0-15cm Very dark greyish brown (10YR 4/2 dry, 10YR 3/2 moist); sandy clay; weak, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine and fine pores; pH-H_2O = 7.8; clear and wavy transition to:
(sample no. 155-56a)

Bt 15-39cm Very dark greyish brown (10YR 3/2 dry/moist); sandy clay; strong, fine to medium, prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; common very fine pores; pH-H_2O = 8.3; clear and smooth transition to:
(sample no. 155-56b)

Btk1 39-61cm Very dark greyish brown (10YR 3/2 moist); clay; weak, fine to medium, prismatic structure breaking to moderate, very fine to fine, subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; some soft powdery lime; many fine pores; pH-H_2O = 8.8; gradual and smooth transition to:
(sample no. 155-56c)

Btk2 61-101cm Dark greyish brown (10YR 4/2 moist); clay; weak, coarse to very coarse, prismatic structure breaking to weak, fine to medium subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; some soft powdery lime; many very fine pores; pH-H_2O = 9.1; gradual and smooth transition to:
(sample no. 155-56d)

ty	101-165cm	Greyish brown (10YR 5/2 moist); clay; weak, coarse to very coarse, prismatic structure breaking to moderate, fine to medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; broken, thin clayskins; strongly calcareous; some gypsum crystals; many very fine pores; $pH\text{-}H_2O = 9.1$ (sample no. 155-56e)
y1	165-205cm (augered)	Grey (10YR 5/1 moist); gravelly clay; slightly sticky and slightly plastic when wet; strongly calcareous; some gypsum crystals; (sample no. 155-56f)
y2	205-245cm (augered)	Grey (10YR 5/1 moist); gravelly clay; slightly sticky and slightly plastic when wet; strongly calcareous; some gypsum crystals; (sample no. 155-56g)
	245-265cm (augered)	Light grey to grey (10YR 6/1 moist); clay; slightly sticky and slightly plastic when wet; slightly calcareous. (sample no. 155-56h)

LABORATORY DATA OF PROFILE DESCRIPTION No: 25

FIELD OBSERVATION No: 155-56 MAPPING UNIT: Ps 2.11 SOIL CLASSIFICATION: luvic XEROSOL

Laboratory no. ..... /79	5853	5854	5855	5856	5857	5858
Horizon	A	Bt	Btk1	Btk2	Bty	Cy1
Depth (cm)	0-15	15-39	39-61	61-101	101-165	165-205
pH-H_2O(1: 2½ v/v)	8.8	9.0	8.4	8.3	8.2	8.2
pH-KCl ..	7.5	7.7	7.8	7.8	7.8	7.8
EC(mmho/cm) ..	0.19	1.5	8.0	11.5	11.5	10.5
$CaCO_3$ (%)						
$CaSO_4$ (%)	tr	tr	tr	tr	0.7	0.9
C (%)	0.85					
N (%)						
C/N						
CEC (me/100g), pH 8.2	27.4	24.8	31.0	31.0	33.5	31.6
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	32.0	39.3	54.0	73.7	70.5	82.0
.. Mg ..	1.0	1.7	2.3	2.4	2.5	2.0
.. K ..	2.9	1.3	1.3	1.2	1.1	0.9
.. Na ..	1.3	2.5	3.8	4.3	5.3	4.8
Sum of cations	37	45	61	82	79	90
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
.. .. %, pH 7.0						
ESP at pH 8.2	5	10	12	14	16	15
Saturation extract:						
Moisture %		87	80	146	110	133
pH-paste		8.0	7.8	7.3	7.2	7.3
ECe (mmho/cm)		3.5	29.0	26.0	29.5	24.0
Na (me/l)		32.6	32.6	33.6	224	294
K ..		0.43	0.87	0.65	0.65	0.65
Ca ..		5.0	25.2	44.6	54.5	39.0
Mg ..		1.6	32.7	45.4	63.0	36.5
Sum of cations(me/l)		39.6	91.4	124	342	370
CO_3 (me/l)		1.00	1.10	1.08	0.88	0.56
HCO_3 ..		3.40	2.80	1.68	1.72	1.08
Cl ..		-	328	377	300	301
SO_4 ..		-	9.04	10.8	9.94	12.3
Sum of anions(me/l)		-	338	389	311	314
SAR		18	6	5	29	48
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	0-15	15-39	39-61	61-101	101-165	165-205
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	50	48	40	30	26	36
Silt % 0.05–0.002mm	6	6	6	2	4	0
Clay % 0.002–0 mm	44	46	54	68	70	64
Texture class	SC	SC	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–15 cm) Laboratory no. 5853 / 79

			Available	Total
pH-H_2O (1:2½ v/v)	8.1			
Exch. acidity (me/100g)	-	Na (me/100g)	0.78	
C%	0.85	K ..	0.82	
N%	-	Ca ..	25.0	
P-Olsen (ppm)		Mg ..	5.7	
		Mn ..	0.72	
		P (ppm)	12	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

LABORATORY DATA OF PROFILE DESCRIPTION No: 25 cont'd

D OBSERVATION No: 155-56 **MAPPING UNIT:** Pa 2.11

oratory no. .....✓	5859	5860				
izon	Cy2	C				
th (cm)	205-245	245-265				
-H_2O(1: v/v)	8.1	8.1				
-KCl ..	7.5	7.4				
(mmho/cm) ..	10.0	9.5				
CO_3(%)						
SO_4(%)	1.0	0.1				
%)						
%)						
/						
C (me/100g), pH 8.2	30.7	38.0				
C .. .. pH 7.0						
h.Ca (me/100g)	32.0	35.5				
Mg ..	1.5	2.4				
K ..	0.7	0.7				
Na ..	4.3	5.8				
of cations	39	44				
e sat. %, pH 8.2	100+	100+				
.. %, pH 7.0						
at pH 8.2	14	15				
turation extract:						
sture %	49	46				
paste	7.6	7.4				
(mmho/cm)	25.0	22.5				
me/l)	326	294				
..	0.65	0.43				
..	39.0	31.6				
..	40.0	37.4				
of cations(me/l)	406	363				
(me/l)	0.84	0.72				
3 "	1.16	1.14				
..	328	261				
..	19.3	15.1				
of anions(me/l)	348	277				
SAR	52	50				
y mineralogy:						
/Al_2O_3(mol/mol)						
/R_2O_3 ..						
$_3$(mmol%)						
y report:						

SOIL CLASSIFICATION: luvic XEROSOL

Depth (cm)	205-245	245-265				
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	38	28				
Silt % 0.05–0.002mm	2	6				
Clay % 0.002–0 mm	60	68				
Texture class	C	C				
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /		
pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Profile description no. 26

Observation/date	: 155-57; Garissa District, Bura East Project/7-7-79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.11
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chloris roxburghiana, Tetrapogon tenellus, Dactyloctenium scindicum, Cordia sinensis, Dobera glabra; bushed grassland
Salinity/sodicity	: Strongly saline from 182cm, strongly sodic from 60cm
Surface sealing	: Nil
Drainage class	: Imperfectly drained

A 0-6cm Greyish brown (10YR 5/3 dry, 10YR 5/2 moist); sandy clay; massive to weak, coarse, subangular blocky structure; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; common, fine to medium pores; common, very fine roots; pH-H_2O = 6.9; abrupt and smooth transition to:
(sample no. 155-57a)

AB 6-24cm Dark greyish brown (10YR 4/3 dry, 10YR 4/2 moist); sandy clay; moderate, medium to coarse, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine and fine, few medium pores; many, very fine and fine roots; pH-H_2O = 7.5; gradual and wavy transition to:
(sample no. 155-57b)

Bt1 24-60cm Dark greyish brown (10YR 4/2 moist); sandy clay; moderate, coarse prismatic breaking to weak, medium to coarse, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few, very fine to medium pores; common very fine, few coarse roots; pH-H_2O = 7.4; gradual and smooth transition to:
(sample no. 155-57c)

Bt2 60-100cm Dark grey (10YR 4/1 moist); clay; moderate, medium to coarse, prismatic breaking to moderate, fine to medium, angular blocky structure; hard when dry; firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few, very fine to fine pores; few, very fine roots; pH-H_2O = 7.2; gradual and smooth transition to:
(sample no. 155-57d)

BCk	100-147cm	Greyish brown (10YR 6/3 dry, 10YR 5/2 moist); clay; weak, coarse prismatic breaking to moderate, medium to coarse, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; 3-5% small $CaCO_3$ concretions; few, very fine to fine pores; very few, very fine roots; $pH\text{-}H_2O = 8.0$; gradual and smooth transition to: (sample no. 155-57e)
Ck1	147-182cm (augered)	Greyish brown (10YR 6/3 dry, 10YR 5/2 moist); clay; friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; 3-5% small $CaCO_3$ concretions; $pH\text{-}H_2O=8.0$ (sample no. 155-57f)
Ck2	182-263cm (augered)	Greyish brown (10YR 6/2 dry, 10YR 5/2 moist); clay; friable when moist; slightly sticky and plastic when wet; strongly calcareous; 3-5% small $CaCO_3$ concretions; $pH\text{-}H_2O =$ 7.9 (sample no. 155-57g)
C	263-380 (augered)	Greyish brown (10YR 5/2 moist); clay. (sample nos. 155-57h and j)

Note: The Bt1 and Bt2 horizons are compact.

LABORATORY DATA OF PROFILE DESCRIPTION No: 26

FIELD OBSERVATION No: 155-57 MAPPING UNIT: Ps 2.11 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no...../79	10193	10194	10195	10196	10197	10198
Horizon	A	AB	Bt1	Bt2	BCk	Ck1
Depth (cm)	0-6	6-24	24-60	60-100	100-147	147-182
pH-H_2O(1:2½ v/v)	8.4	8.6	8.5	8.8	8.3	8.4
pH-KCl ,,	7.1	7.2	7.3	7.5	7.7	7.7
EC(mmho/cm) ,,	0.35	0.25	0.30	0.85	0.90	1.4
$CaCO_3$(%)	-	-	-	-	-	-
$CaSO_4$(%)	tr	tr	tr	tr	0.7	1.2
C (%)	0.74	0.53	0.36	0.3	0.27	0.12
N (%)						
C/N						
CEC (me/100g), pH 8.2	28.2	34.8	38.0	41.2	38.0	41.2
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	26.0	39.0	40.0	30.0	26.0	28.0
,, Mg ,,	4.9	6.5	12.2	7.5	9.4	13.6
,, K ,,	5.4	2.1	1.4	1.4	0.2	0.9
,, Na ,,	1.2	1.2	1.2	15.3	11.0	20.0
Sum of cations	38	49	55	54	47	53
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
,, ,, %, pH 7.0						
ESP at pH 8.2	4	4	3	37	29	49
Saturation extract:						
Moisture %	31	56	60	73	72	115
pH-paste	6.9	7.5	7.4	7.2	8.0	8.0
ECe (mmho/cm)	1.00	0.95	0.55	2.0	2.9	4.0
Na (me/l)	3.0	5.0	1.9	10.9	27.0	37.0
K ,,	1.41	0.48	0.22	0.32	0.19	0.13
Ca ,,	3.0	2.4	2.0	2.6	1.2	1.6
Mg ,,	2.6	1.4	1.1	3.2	1.1	1.3
Sum of cations(me/l)	10.0	9.3	5.2	17.02	29.5	40.0
CO_3(me/l)	-	0.10	0.20	-	1.09	1.10
HCO_3 ,,	5.0	6.0	3.8	9.0	7.0	6.6
Cl ,,	4.50	2.0	1.50	10.0	19.0	75.0
SO_4 ,,	1.24	1.24	0.62	0.62	0.62	3.1
Sum of anions(me/l)	10.7	9.3	6.1	19.6	26.6	85.8
SAR	2	4	2	6	25	31
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	0-6	6-24	24-60	60-100	100-147	147-182
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	50	52	48	44	38	40
Silt % 0.05-0.002mm	6	2	6	6	10	8
Clay % 0.002-0 mm	44	46	46	50	52	52
Texture class	SC	SC	SC	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30cm) Laboratory no. 10086/ 79

			Available	Total
pH-H_2O (1: 2½ v/v)	7.9			
Exch. acidity (me/100g)		Na (me/100g)	0.42	
C%	0.62	K ,,	1.56	
N%		Ca ,,	23.6	
P-Olsen (ppm)		Mg ,,	6.5	
		Mn ,,	0.65	
		P (ppm)	20	

Various:

Remarks:

1-92

LABORATORY DATA OF PROFILE DESCRIPTION No: 26 Continued.

FIELD OBSERVATION No: 155-57 MAPPING UNIT: Ps 2.11

Laboratory no. ..... /79	10199	12850	12851			
Horizon	Ck2	C	C			
Depth (cm)	182-263	263-319	319-380			
$pH-H_2O$ (1:2½ v/v)	8.0	-	-			
pH-KCl ..	7.6	-	-			
EC (mmho/cm) ..	3.0	-	-			
$CaCO_3$ (%)	-	1.0	1.4			
$CaSO_4$ (%)						
C (%)	0.15	-	-			
N (%)						
C/N						
CEC (me/100g), pH 8.2	41.2	37.4	37.4			
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	21.0	15.8	13.0			
.. Mg ..	7.9	-	-			
.. K ..	0.6	0.3	tr			
.. Na ..	15.9	13.1	15.4			
Sum of cations	45	-	-			
Base sat. %, pH 8.2	100+	-	-			
.. .. %, pH 7.0						
ESP at pH 8.2	39	35	41			
Saturation extract:						
Moisture %	80	74	78			
pH-paste	7.9	7.8	7.8			
ECe (mmho/cm)	15.0	15.0	15.5			
Na (me/l)	123	120	131			
K ..	0.26	0.15	0.21			
Ca ..	11.6	12.0	10.5			
Mg ..	14.4	15.4	13.3			
Sum of cations (me/l)	149	148	155			
CO_3 (me/l)	-	0	0			
HCO_3 ..	6.0	8.1	8.0			
Cl ..	167.0	137	143			
SO_4 ..	4.3	4.8	3.8			
Sum of anions (me/l)	177	150	155			
SAR	34	32	38			
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report:

SOIL CLASSIFICATION: haplic XEROSOL

Depth (cm)	182-263	263-319	319-380			
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	42	38	38			
Silt % 0.05-0.002mm	8	10	10			
Clay % 0.002-0 mm	50	52	52			
Texture class	C	C	C			
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25 mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0- cm)		Laboratory no. /		
$pH-H_2O$ (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 27

Observation/date : 155-66, Garissa District, Bura East Project/11-7-79

Soil classification : haplic XEROSOL

Mapping unit : Ps 2.11

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Cymbopogon pospichilii, Dactyloctenium scindicum, Ehretia sp., Maytenus sp; bushed grassland

Salinity/sodicity : Moderately saline from 58cm and strongly saline from 81cm; strongly sodic from 18cm

Surface sealing : 2cm weak

Drainage class : Imperfectly drained

A 0-18cm Dark greyish brown (10YR 5/2 dry, 10YR 4/2 moist); clay; weak, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many very fine, few fine pores; common very fine and fine, few medium roots; pH-H_2O = 8.2;

(sample no. 155-66a)

Bt 18-58cm Dark grey (10YR 4/1 moist); clay; moderate, coarse, prismatic structure breaking to moderate, medium to coarse, angular blocky; very hard when dry, firm when moist, sticky and plastic when wet; patchy, moderately thick clayskins; strongly calcareous; common very fine, few fine pores; few, very fine and fine roots; pH-H_2O = 9.0;

(sample no. 155-66b)

Bky 58-81cm Dark greyish brown (10YR 4/2 moist); clay; weak, fine to medium, subangular blocky structure; slightly hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous; some soft powdery lime and gypsum crystals; few, very fine and fine pores; few, very fine and fine roots; pH-H_2O = 8.3;

(sample no. 155-66c)

BCky 81-173cm Dark greyish brown (10YR 4/2 moist); clay; weak, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; some soft powdery lime and gypsum; common very fine, few fine and medium pores; few very fine roots (some dead);

(sample no. 155-66d)

C	173-233cm (augered)	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; strongly calcareous; pH-H_2O = 8.0 (sample no. 155-66e)

LABORATORY DATA OF PROFILE DESCRIPTION No: 27

ELD OBSERVATION No: 155-66 MAPPING UNIT: Ps 2.11 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ..... / 79	10242	10243	10244	10245	10246	
Horizon	A	Bt	Bky	BCky	C	
Depth (cm)	0-18	18-58	58-81	81-173	173-233	
pH-H_2O(1: 2½ v/v)	8.3	8.9	9.0	8.8	8.7	
pH-KCl ..	7.3	7.6	7.7	7.8	7.7	
EC (mmho/cm) ..	0.35	0.5	1.9	4.5	6.5	
$CaCO_3$ (%)						
$CaSO_4$ (%)	0.1	0.1	0.2	0.4	0.3	
C (%)	0.46	0.29	0.20	0.15	0.12	
N (%)						
C/N						
CEC (me/100g), pH 8.2	40.0	38.0	44.4	46.6	54.0	
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	36.0	36.0	26.0	50.0	41.0	
.. Mg ..	13.2	14.6	13.2	0.9	4.9	
.. K ..	0.7	0.7	0.4	tr.	0.6	
.. Na ..	2.5	10.5	21.0	13.5	17.0	
Sum of cations	52	62	61	64	64	
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	
.. .. %, pH 7.0	6	28	47	29	31	
ESP at pH 8.2						
Saturation extract:						
Moisture %	55	70	76	81	107	
pH-paste	8.2	9.0	8.3	-	8.0	
ECe (mmho/cm)	0.50	0.24	8.00	17.50	20.50	
Na (me/l)	1.25	-	70.0	135	177	
K ..	0.17	-	0.21	0.24	0.14	
Ca ..	2.2	-	4.2	16.3	12.3	
Mg ..	1.4	-	5.0	23.2	16.4	
Sum of cations (me/l)	5.0	-	79.4	175	206	
CO_3 (me/l)	-	-	-	-	-	
HCO_3 ..	2.0	-	7.0	10.0	7.0	
Cl ..	2.4	-	72.0	155	191	
SO_4 ..	0.31	0.31	0.62	9.0	6.0	
Sum of anions (me/l)	4.7	-	79.6	174	204	
SAR	1	-	33	30	47	
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report: A and Bt horizons: Montmorillonite and illite.

Depth (cm)	0-18	18-58	58-81	81-173	173-233	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	42	40	44	38	30	
Silt % 0.05–0.002 mm	6	2	2	4	4	
Clay % 0.002–0 mm	52	58	54	58	66	
Texture class	C	C	C	C	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0 mm						
.. .. 1.0 – 0.50 mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10 mm						
.. .. 0.10 – 0.05 mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH-H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Profile description no. 28

Observation/date	: 155-82; Garissa district; Bura East project area; 8/9/79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.12
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chloris roxburghiana, Duosperma eremophilum, Indigofera schimperi; bushed grassland
Salinity/sodicity	: Moderately saline from 88cm; strongly sodic from 18cm
Surface sealing	: 1-3mm thick, moderate
Drainage class	: Imperfectly drained

A 0-18cm Dark greyish brown (10YR 5/2 dry, 10YR 4/2 moist); clay; strong, very fine and fine, crumby structure; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; many, very fine and fine pores; many, very fine and fine roots; pH-H_2O = 8.6; clear and wavy transition to:

(sample no. 155-82a)

Bt1 18-55cm Dark greyish brown (10YR 4/2 moist); clay; strong, coarse to very coarse, prismatic structure breaking into weak, medium to coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; many, very fine and fine pores; common very fine and fine, few medium roots; pH-H_2O = 9.3; clear and smooth transition to:

(sample no. 155-82b)

Bt2 55-88cm Dark grey (10YR 4/1 moist); clay; weak, medium to coarse, prismatic structure; firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; common, very fine and fine pores; very few, very fine (dead) roots; pH-H_2O = 9.0; gradual and smooth transition to:

(sample no. 155-82c)

88-109cm Dark greyish brown (10YR 4/2 moist); clay; moderate, medium to coarse angular blocky structure; firm when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; common, very fine and fine pores; very few, very fine and fine (dead) roots; pH-H_2O = 8.5; clear and smooth transition to:

(sample no. 155-82d)

C 109-211cm

Grey (10YR 5/1 moist); clay; moderate to strong, fine to medium, angular blocky structure; firm when moist, sticky and plastic when wet; common, moderate slickensides; strongly calcareous; common, very fine and fine pores; very few, very fine and fine (dead) roots; pH-H_2O = 8.4

(sample nos. 155-82e and f)

Note: 5-10mm wide cracks extend into the Bt2-horizon, in which they are partly filled up with sand.

LABORATORY DATA OF PROFILE DESCRIPTION No: 28

FIELD OBSERVATION No: 155-82 MAPPING UNIT: Ps 2.12 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	12890	12891	12892	12893	12894	12895
Horizon	A	Bt1	Bt2	BC	C	C
Depth (cm)	0–18	18–55	55–88	88–109	109–133	133–211
pH–H_2O(1: 2½ v/v)	8.1	9.3	9.4	8.9	9.1	8.8
pH–KCl ,,						
EC(mmho/cm) ,,	0.25	0.50	1.4	4.5	3.5	4.5
$CaCO_3$(%)	0.4	2.1	2.2	2.2	2.0	1.9
$CaSO_4$(%)	tr	tr	tr	0.4	0.2	1.4
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	27.9	27.5	32.2	31.8	33.4	–
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	35.5	58.6	32.7	14.7	15.7	–
,, Mg ,,	1.6	4.2				–
,, K ,,	3.5	1.5	0.8	0.5	0.4	–
,, Na ,,	0.3	6.8	14.7	20.6	14.9	–
Sum of cations	41	71				–
Base sat. %, pH 8.2	100+	100+				–
,, ,, %, pH 7.0						
ESP at pH 6.2	1	25	46	65	45	–
Saturation extract:						
Moisture %	54	46	54	98	96	98
pH–paste	8.1	7.8	7.8	7.8	7.6	8.0
ECe (mmho/cm)	0.40	0.3	0.40	14.0	17.0	14.5
Na(me/l)	2.00	1.25	1.40	126	150	142
K ,,	0.20	0.22	0.24	0.24	0.22	0.22
Ca ,,	1.00	1.50	2.00	5.00	6.50	1.50
Mg ,,	1.50	1.00	1.46	8.75	13.3	0.40
Sum of cations(me/l)	4.7	4.0	5.1	140	170	144
CO_3(me/l)	0	0	0	0	0	0
HCO_3 ,,	2.32	2.00	3.50	7.3	7.6	8.0
Cl ,,	1.20	0.10	0.50	130	160	135
SO_4 ,,	0.94	0.94	0.94	0.94	1.88	0.94
Sum of anions(me/l)	4.5	3.0	4.9	138	169	144
SAR	2	1	1	48	48	–
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report: A and Bt1 horizons: Illite grading into montmorillonite, both poorly crystallized.

Depth (cm)	0–18	18–55	55–88	88–109	109–133	133–211
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	44	40	38	30	32	32
Silt % 0.05–0.002mm	2	6	4	6	6	6
Clay % 0.002–0 mm	54	54	58	64	62	62
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30 cm) Laboratory no. 12739/ 79

			Available	Total
pH–H_2O (1: 2½ v/v)	8.0			
Exch. acidity (me/100g)	–	Na (me/100g)	0.47	
C%	0.59	K ,,	1.00	
N%		Ca ,,	17.6	
P–Olsen(ppm)		Mg ,,	7.0	
		Mn ,,	0.39	
		P (ppm)	20	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 78858

Profile description no. 29

Observation/date	: 155-85; Garissa district; Bura East Irrigation project; 12/9/79
Soil classification	: calcic or haplic XEROSOL
Mapping unit	: Ps 2.12
Parent material	: Marine/lacustrine sediments
Physiography	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Chloris roxburghiana, Combretum hereroense; bushed grassland
Salinity/sodicity	: Moderately saline from 40cm and strongly saline from 72cm; strongly sodic from 10cm
Surface sealing	: 2mm thick, moderate
Drainage class	: Imperfectly drained

A 0-10cm Very dark grey (10YR 5/1 dry, 10YR 3/1 moist); clay; moderate, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; many very fine, few fine pores; many, very fine and fine roots; pH-H_2O = 7.8; clear and smooth transition to:

(sample no. 155-85a)

Bt 10-40cm Very dark grey (10YR 3/1 dry and moist); clay; moderate, coarse to very coarse, prismatic structure breaking into weak, medium to coarse, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; calcareous; few, very fine, fine and medium pores; common very fine, few fine roots; moderate biological activity; pH-H_2O = 9.1; gradual and smooth transition to:

(sample no. 155-85b)

Btk 40-72cm Dark greyish brown (10YR 4/2 moist); few, fine, faint, grey mottles; clay; moderate, medium to coarse, angular blocky structure; firm when moist, sticky and plastic when wet; broken moderately thick clayskins; calcareous; some soft powdery lime; common very fine, few fine and medium pores; few, very fine and medium roots; moderate biological activity; pH-H_2O = 8.5; gradual and wavy transition to:

(sample no. 155-85c)

Btky	72-108cm	Very dark greyish brown (10YR 3/2 moist); clay; weak, medium, angular blocky structure; firm when moist, sticky and plastic when wet; few, weak slickensides and patchy, thin clayskins; calcareous; about 5% $CaCO_3$ concretions and soft powdery lime; 3-5% gypsum crystals; many, very fine pores; no roots observed; pH-H_2O = 8.0; diffuse and smooth transition to: (sample no. 155-85d)
BCyz	108-157cm	Grey (10YR 5/1 moist); clay; moderate, very fine and fine angular blocky structure; friable when moist, sticky and plastic when wet; broken, moderately thick clayskins; non-calcareous; many gypsum and salt crystals; pH-H_2O = 8.2; (sample no. 155-85e)
C1	157-247cm (augered)	Light grey to grey (10YR 6/1 moist); clay; sticky and plastic when wet; pH-H_2O is about 8.0 (sample nos. 155-85f, g and h)

LABORATORY DATA OF PROFILE DESCRIPTION No: 29

FIELD OBSERVATION No: 155-85 MAPPING UNIT: Ps 2.12 SOIL CLASSIFICATION: calcic or haplic XEROSOL

Laboratory no. ..... /79	12968	12969	12970	12971	12972	12973
Horizon	A	Bt	Btk	Btky	BCys	C1
Depth (cm)	0-10	10-40	40-72	72-108	108-157	157-184
pH-H_2O (1:2½ v/v)	8.1	8.9	8.4	8.2	8.4	8.2
pH-KCl "						
EC (mmho/cm) "	0.75	0.90	5.0	7.0	7.0	7.0
$CaCO_3$ (%)	2.0	2.4	2.5	2.3	3.1	3.1
$CaSO_4$ (%)	tr	tr	tr	0.8	0.4	0.3
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	40.0	32.5	36.2	38.2	35.8	-
CEC " " pH 7.0						
Exch.Ca (me/100g)	35.2	46.2	63.7	22.2	21.2	-
" Mg "	2.4	1.7	-	-	-	-
" K "	2.4	1.3	0.2	0.1	0.2	-
" Na "	1.3	6.7	12.1	9.3	12.6	-
Sum of cations	41	56	-	-	-	-
Base sat. %, pH 8.2	100+	100+	-	-	-	-
" " %, pH 7.0						
ESP at pH 8.2	3	21	33	24	35	-
Saturation extract:						
Moisture %	51	77	77	75	85	-
pH-paste	7.8	8.6	7.5	7.4	7.4	-
ECe (mmho/cm)	1.3	4.0	13.0	20.0	21.0	-
Na (me/l)	5.00	-	97.0	140	150	-
K "	0.13	-	0.28	0.44	0.18	-
Ca "	5.75	-	16.3	29.3	28.5	-
Mg "	2.71	-	17.1	32.1	30.0	-
Sum of cations (me/l)	13.6	-	131	202	209	-
CO_3 (me/l)	0	0	0	0	0	-
HCO_3 "	5.99	-	10.7	7.3	8.66	-
Cl "	6.10	-	112	182	190	-
SO_4 "	1.00	1.00	7.30	10.3	13.0	-
Sum of anions (me/l)	13.1	-	130	200	212	-
SAR	2	-	24	25	28	-
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 "						
Fe_2O_3 (mmol%)						

X-ray report:

Depth (cm)	0-10	10-40	40-72	72-108	108-157	157-184
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	42	42	36	36	36	30
Silt % 0.05-0.002mm	6	4	10	2	2	2
Clay % 0.002-0 mm	52	54	54	62	62	62
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
" " 1.0 - 0.50mm						
" " 0.50 - 0.25 mm						
" " 0.25 - 0.10mm						
" " 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30 cm) Laboratory no. 12732 /79

			Available	Total
pH-H_2O (1:2½ v/v)	8.4		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	1.60	
C%	0.71	K "	0.34	
N%		Ca "	27.4	
P-Olsen (ppm)		Mg "	7.0	
		Mn "	0.14	
		P (ppm)	14	

Various:

Remarks:

1-102

LABORATORY DATA OF PROFILE DESCRIPTION No: 29 Continued.

OBSERVATION No: 155-85 MAPPING UNIT: Ps 2.12 SOIL CLASSIFICATION: calcic or haplic XEROSOL.

ratory no. ..... /79	12974	12975				
zon	C2	C3				
h (cm)	184-220	220-247				
H_2O(1:2½ v/v)	8.2	8.0				
KCl ..						
mmho/cm) ..	7.5	7.0				
O_3(%)	2.1	0.9				
O_4(%)	0.4	0.7				
)						
)						
(me/100g), pH 8.2	33.4	32.2				
.. .. pH 7.0						
h.Ca (me/100g)	21.2	13.6				
Mg ..	–	–				
K ..	0.2	0.2				
Na ..	12.1	8.2				
of cations	–	–				
e sat. %, pH 8.2	–	–				
.. %, pH 7.0						
at pH 8.2	36	25				
turation extract:						
sture %	125	131				
paste	7.6	7.7				
(mmho/cm)	17.5	17.0				
me/l)	146	142				
..	0.13	0.38				
..	11.3	11.0				
..	17.7	17.1				
of cations(me/l)	175	170				
(me/l)	0	0				
O_3 ..	4.66	7.99				
..	167	158				
..	3.60	3.90				
of anions(me/l)	175	170				
SAR	38	38				
lay mineralogy:						
$/Al_2O_3$(mol/mol)						
$/R_2O_3$ ..						
O_3(mmol%)						
ay report:						

Depth (cm)	184-220	220-247				
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	26	28				
Silt % 0.05–0.002mm	8	6				
Clay % 0.002–0 mm	66	66				
Texture class	C	C				
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH–H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen(ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 30

Observation/date : 155-88; Garissa district; Bura East project area; 11/9/79

Soil classification : luvic XEROSOL

Mapping unit : Ps 2.12

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Chrysopogon aucheri, Chloris roxburghiana, Indigofera schimperi; bushed grassland

Salinity/sodicity : Slightly saline from 70cm and strongly saline and strongly sodic from 112cm

Surface sealing : 1-3mm thick, strong

Drainage class : Imperfectly drained

A 0-10cm Dark greyish brown (10YR 4/2 dry and moist); sandy clay; moderate, very fine to fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; calcareous; many, fine pores; many, very fine and fine roots; pH-H_2O = 8.2; clear and smooth transition to:

(sample no. 155-88a)

Bt 10-33cm Dark grey (10YR 5/2 dry, 10YR 4/1 moist) clay; moderate, medium to coarse, prismatic structure breaking into weak, medium to coarse, angular blocky; slightly hard when dry, firm when moist, sticky and plastic when wet; few, weak slickensides; calcareous; few very fine and fine few medium pores; common, very fine and fine roots; moderate biological activity; pH-H_2O = 8.4; gradual and wavy transition to:

(sample no. 155-88b)

Btk 33-70cm Dark greyish brown (10YR 4/2 moist); few, fine, faint, grey mottles; clay; moderate, coarse to very coarse, prismatic structure breaking into moderate, coarse, angular blocky; firm when moist, sticky and plastic when wet; patchy, thin clayskins and common, weak slickensides; strongly calcareous; about 2% soft powdery lime; common, very fine pores; few, very fine roots; pH-H_2O = 8.0; diffuse and smooth transition to:

(sample no. 155-88c)

Btky	70-112cm	Dark brown (10YR 4/3 moist); few, fine, faint, grey mottles; clay; weak, coarse, angular blocky structure; firm when moist, sticky and plastic when wet; few, weak slickensides; strongly calcareous; about 2% soft powdery lime and about 5% gypsum crystals; common, very fine pores; few, very fine roots; pH-H_2O = 8.1; gradual and smooth transition to: (sample no. 155-88d)
BCyz	112-178cm	Brown (10YR 5/3 moist); common, fine, faint, grey mottles; clay; weak, fine, medium and coarse, angular blocky structure; firm when moist, sticky and plastic when wet; few, weak slickensides; strongly calcareous; many gypsum and salt crystals; common, very fine pores; no roots observed; pH-H_2O = 8.6; (sample no. 155-88e)
C	178-270cm (augered)	Light grey to grey (10YR 6/1 moist); clay; sticky and plastic when wet; slightly calcareous.

LABORATORY DATA OF PROFILE DESCRIPTION No: 30

.D OBSERVATION No: 155-88 MAPPING UNIT: Pe 2.12

SOIL CLASSIFICATION: luvic XEROSOL

boratory no. ...../ 79	13023	13024	13025	13026	13027	
rizon	A	Bt	Btk	Btky	BCys	
pth (cm)	0-10	10-33	33-70	70-112	112-178	
-H_2O(1:2½ v/v)	8.7	8.8	7.6	7.5	8.5	
-KCl ..						
(mmho/cm) ..	0.35	0.40	1.8	2.8	5.5	
CO_3 (%)	3.5	4.2	4.1	4.0	4.5	
SO_4 (%)	tr	tr	tr	0.7	1.1	
(%)						
(%)						
N						
C (me/100g), pH 8.2	35.1	31.5	32.5	32.2	39.8	
C .. .. pH 7.0						
ch.Ca (me/100g)	56.5	54.7	76.0	4.9	4.0	
Mg ..	1.1	2.1	1.5	-	-	
K ..	1.9	0.7	0.8	0.1	0.6	
Na ..	0.8	1.8	1.9	3.5	14.2	
n of cations	60	59	80	-	-	
se sat. %, pH 8.2	100+	100+	100+	-	-	
.. %, pH 7.0						
P at pH 8.2	2	6	6	11	36	
turation extract:						
sture %	47	65	62	68	108	
-paste	8.2	8.4	7.8	8.1	7.9	
(mmho/cm)	0.75	0.55	3.0	5.5	16.0	
me/l)	2.05	1.30	21.3	15.0	113	
..	0.41	0.26	0.26	0.64	0.56	
..	2.0	2.10	8.80	24.8	19.3	
..	-	-	-	16.3	27.9	
of cations(me/l)	-	-	-	56.7	161	
(me/l)	0	tr	0	0	0	
3 ..	0.67	0.67	3.90	3.33	6.67	
..	6.00	3.76	21.5	44.0	135	
..	0.64	0.32	4.48	8.48	18.9	
f anions(me/l)	7.3	4.8	29.9	55.8	160.6	
SAR	-	-	-	3	23	
y mineralogy:						
Al_2O_3(mol/mol)						
R_2O_3 ..						
3(mmol%)						

y report:

Depth (cm)	0-10	10-33	33-70	70-112	112-178	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	50	42	42	40	36	
Silt % 0.05-0.002mm	6	10	2	2	4	
Clay % 0.002-0 mm	44	48	56	58	60	
Texture class	SC	C	C	C	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25 mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30 cm) Laboratory no. 12725 /79

pH-H_2O (1: 2½ v/v)	8.5		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	2.51	
C%	0.83	K ..	0.24	
N%	-	Ca ..	25.9	
P-Olsen (ppm)		Mg ..	7.2	
		Mn ..	0.12	
		P (ppm)	8	

Various:

Remarks:

Profile description no. 31

Observation/date	: 155-89 Garissa district, Bura East project area; 11/9/79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 2.12
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Sporobolus helvolus, Indigofera schimperi, Acacia reficiens; bushed grassland
Salinity/sodicity	: Moderately saline from 50cm and strongly saline from 102cm; strongly sodic from 25cm
Surface sealing	: 3mm thick, weak
Drainage class	: Imperfectly drained

A 0-10cm

Greyish brown (10YR 5/2 dry and moist); clay; weak, very fine, crumby structure and weak, very fine to fine, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; calcareous; many, fine pores; common, very fine and fine roots; pH-H_2O = 8.3; clear and smooth transition to:

(sample no. 155-89a)

AB 10-25cm

Dark greyish brown (10YR 4/2 dry and moist); clay; moderate, medium to coarse, prismatic structure breaking into weak, medium, subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; calcareous; many very fine and common fine pores; common, very fine and fine roots; pH-H_2O = 9.2; gradual and smooth transition to:

(sample no. 155-89b)

Btk 25-50cm

Greyish brown (10YR 5/2 moist); clay; moderate, coarse to very coarse, prismatic structure breaking into moderate, medium and coarse, angular blocky; hard when dry, firm when moist; sticky and plastic when wet; few, weak slickensides; calcareous; about 1% soft powdery lime; few, very fine and fine pores; few, very fine roots; pH-H_2O = 9.3; gradual and wavy transition to:

(sample no. 155-89c)

Btky	50-102cm	Dark brown to brown (10YR 4/3 moist); common, fine, faint, grey mottles; clay; weak, coarse, angular blocky structure; firm when moist, sticky and plastic when wet; patchy, thin clay skins and few, weak slickensides; slightly calcareous; about 1% soft powdery lime and about 2% gypsum crystals; few, very fine pores; no roots; $pH-H_2O = 8.6$; gradual and smooth transition to: (sample no. 155-89d)
BCz	102-166cm	Grey (10YR 5/1 moist); clay; moderate, fine, medium and coarse, angular blocky structure; firm when moist, sticky and plastic when wet; common, moderate slickensides; non-calcareous; common salt crystals; few, very fine, pores; no roots; $pH-H_2O = 8.6$ (sample no. 155-89e)
C1	166-194cm (augered)	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; non-calcareous; $pH-H_2O = 8.4$ (sample no. 155-89f)
C2	194-257cm (augered)	Light grey to grey (10YR 6/1 moist); clay; sticky and plastic when wet; non-calcareous; $pH-H_2O = 8.2$ (sample no. 155-89g)

LABORATORY DATA OF PROFILE DESCRIPTION No: 31

LD OBSERVATION No: 155-89 MAPPING UNIT: Pe 2.12 SOIL CLASSIFICATION: orthic SOLONETZ

aboratory no. ...../79	13037	13038	13039	13040	13041	13042
orizon	A	AB	Btk	Btky	BCs	C1
epth (cm)	0–10	10–25	25–50	50–102	102–166	166–194
H–H_2O (1: 2½ v/v)	8.0	8.8	9.2	8.5	8.7	8.9
H–KCl ..						
C (mmho/cm) ..	0.50	0.55	0.75	5.0	8.0	7.0
aCO_3 (%)	0.6	4.2	2.1	2.2	3.6	1.6
aSO_4 (%)	0.1	0.1	0.1	0.1	tr	tr
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	32.5	33.0	33.0	37.4	34.6	32.2
EC .. .. pH 7.0						
xch.Ca (me/100g)	54.5	58.5	56.7	20.2	8.6	14.7
.. Mg ..	1.8	3.0	4.2	–	–	–
.. K ..	2.8	1.6	1.3	0.4	0.4	0.3
.. Na ..	1.4	4.2	7.7	7.3	9.6	9.1
m of cations	61	67	70	–	–	–
se sat. %, pH 8.2	100+	100+	100+	–	–	–
.. %, pH 7.0						
P at pH 8.2	4	13	23	20	28	28
aturation extract:						
isture %	55	61	48	47	117	138
–paste	8.3	8.4	8.5	8.0	8.0	7.9
e (mmho/cm)	0.90	0.80	1.0	12.0	16.0	14.0
(me/l)	3.50	6.50	8.00	75.0	130	180
..	0.31	0.31	0.13	0.21	0.21	0.13
..	3.30	0.75	0.75	15.8	11.5	11.5
..	2.10	1.00	0.60	32.1	20.8	20.8
n of cations (me/l)	9.2	8.6	9.5	123	163	140
$_3$ (me/l)	0	tr	0	0	0	0
O_3 ..	0.67	0.67	1.33	7.33	5.98	9.30
..	7.00	6.95	8.00	100	132	120
..	1.12	0.64	1.12	13.9	18.0	8.96
of anions (me/l)	8.8	8.3	10.5	122	156	138
SAR	2	7	10	15	32	45
ay mineralogy:						
$/Al_2O_3$ (mol/mol)						
$/R_2O_3$ ..						
O_3 (mmol%)						

ay report:

Depth (cm)	0–10	10–25	25–50	50–102	102–166	166–194
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	42	36	38	28	24	26
Silt % 0.05–0.002mm	8	10	6	2	8	4
Clay % 0.002–0 mm	50	54	56	70	68	70
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30cm) Laboratory no. 12724 / 79

			Available	Total
pH–H_2O (1: 2½ v/v)	7.9		Available	Total
Exch. acidity (me/100g)	–	Na (me/100g)	0.65	
C%	0.92	K ..	1.12	
N%	–	Ca ..	18.3	
P-Olsen (ppm)		Mg ..	7.2	
		Mn ..	0.98	
		P (ppm)	23	

Various:

Remarks:

Kenya Soil Survey
Drawing No 79050

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LABORATORY DATA OF PROFILE DESCRIPTION No: 31 Continued

IELD OBSERVATION No: 155-89 MAPPING UNIT: Pe 2.12 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	13043					
Horizon	C2					
Depth (cm)	194-257					
pH-H_2O(1:$2\frac{1}{2}$ v/v)	8.5					
pH-KCl ,,						
EC(mmho/cm) ,,	7.0					
$CaCO_3$(%)	1.5					
$CaSO_4$(%)	1.0					
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	41.4					
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	14.7					
,, Mg ,,	–					
,, K ,,	0.2					
,, Na ,,	9.1					
Sum of cations	–					
Base sat. %, pH 8.2	–					
,, ,, %, pH 7.0						
ESP at pH 8.2	22					
Saturation extract:						
Moisture %	149					
pH-paste	7.6					
ECe (mmho/cm)	14.0					
Na (me/l)	132					
K ,,	0.26					
Ca ,,	7.50					
Mg ,,	15.4					
Sum of cations(me/l)	155					
CO_3(me/l)	0					
HCO_3 ,,	9.99					
Cl ,,	124					
SO_4 ,,	5.04					
Sum of anions(me/l)	139					
SAR	39					
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	194-257					
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	24					
Silt % 0.05–0.002mm	6					
Clay % 0.002–0 mm	70					
Texture class	C					
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH-H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ,,		
N%		Ca ,,		
P-Olsen(ppm)		Mg ,,		
		Mn ,,		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 32

Observation/date : 155-91, Garissa district, Bura East project area; 11/9/79

Soil classification : orthic SOLONETZ

Mapping unit : Ps 2.13

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Chrysopogon aucheri, Chloris roxburghiana, Combretum hereroense, Duosperma eremophilum; dwarf shrub grassland

Salinity/sodicity : Moderately saline from 22cm and strongly saline from 50cm, strongly sodic from 22cm onwards

Surface sealing : 1-5mm thick, weak

Drainage class : Imperfectly drained

A 0-22cm Dark grey (10YR 4/2 dry, 10YR 4/1 moist); clay; moderate, medium to coarse, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; calcareous; many, very fine and fine pores; few, very fine and fine roots; pH-H_2O = 8.0; clear and smooth transition to:

(sample no. 155-91a)

BA 22-50cm Dark greyish brown (10YR 4/2 moist); clay; weak, medium to coarse, prismatic structure breaking into moderate, medium to coarse, angular blocky; hard when dry, firm when moist, sticky and plastic when wet; no cutans; calcareous; many, very fine and fine roots; few very fine and fine, very few medium roots; pH-H_2O = 8.3; clear and smooth transition to:

(sample no. 155-91b)

Btk 50-78cm Dark brown (10YR 3/3 moist); clay; moderate, medium to coarse, angular blocky structure; firm when moist, sticky and plastic when wet; no cutans(?); calcareous; lime pseudo mycelium; common, very fine and fine pores; few very fine and fine, very few medium roots; pH-H_2O = 7.9; clear and smooth transition to:

(sample no. 155-91c)

Btky 78-108cm Dark brown (10YR 3/3 moist); clay; strong, very fine and fine, angular blocky structure; firm when moist, sticky and plastic when wet; broken, moderately thick clay skins; 3-5% soft powdery lime and about 5% gypsum crystals; calcareous; many, very fine and fine pores; very few, fine roots; pH-H_2O = 8.0; gradual and smooth transition to:

(sample no. 155-91d)

BCk	108-124cm	Dark grey (10YR 4/1 moist); clay; weak, very fine and fine, angular blocky structure; friable when moist, sticky and plastic when wet; many, strong pressure faces; calcareous; about 10% soft powdery lime;many , very fine and fine pores; very few, very fine roots; pH-H_2O = 7.9; (sample no. 155-91e)
C	124-224cm (augered)	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 8.0 (sample nos. 155-91f, g and h)

LABORATORY DATA OF PROFILE DESCRIPTION No: 32

ELDOBSERVATION No: 155-91 MAPPING UNIT: Ps 2.13 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12864	12865	12866	12867	12868	12869
Horizon	A	BA	Btk	Btky	BCk	C
Depth (cm)	0-22	22-50	50-78	78-108	108-124	124-145
pH-H_2O(1: 2½ v/v)	8.8	8.5	8.2	-	8.1	8.4
pH-KCl ..						
EC(mmho/cm) ..	1.4	2.8	4.0	-	4.0	3.5
$CaCO_3$(%)	2.1	2.2	2.0	1.8	1.9	1.6
$CaSO_4$(%)	tr	tr	tr	tr	tr	tr
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	33.0	57.0	51.4	51.4	39.8	55.0
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	52.2	23.7	31.2	42.2	56.2	22.2
.. Mg ..	2.1	-	-	-	-	-
.. K ..	1.6	0.7	0.5	0.4	0.3	0.2
.. Na ..	4.0	14.8	21.1	21.8	16.9	20.6
Sum of cations	60	-	-	-	-	-
Base sat. %, pH 8.2	100+	-	-	-	-	-
.. .. %, pH 7.0						
ESP at pH 8.2	12	26	41	42	42	37
Saturation extract:						
Moisture %	70	83	122	107	100	70
pH-paste	8.0	7.1	7.5	7.6	7.6	7.7
ECe (mmho/cm)	1.5	14.0	18.0	17.5	16.5	12.5
Na (me/l)	12.5	106	123	122	111	103
K ..	0.03	0.21	0.26	0.15	0.15	0.10
Ca ..	1.0	22.0	34.5	34.5	35.5	11.5
Mg ..	1.25	12.5	23.0	18.8	17.9	9.6
Sum of cations(me/l)	15.1	141	181	175	165	124
CO_3(me/l)	0	0	0	0	0	0
HCO_3 ..	7.3	7.2	6.9	8.4	7.9	8.0
Cl ..	-	125	164	158	148	113
SO_4 ..	-	6.1	9.5	8.4	8.7	3.8
Sum of anions(me/l)	-	138	180	175	165	125
SAR	12	26	23	24	21	32
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	0-22	22-50	50-78	78-108	108-124	124-145
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	42	38	32	32	34	26
Silt % 0.05-0.002mm	8	8	2	2	4	10
Clay % 0.002-0 mm	50	54	66	66	62	64
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
.. .. 1.0 - 0.50mm						
.. .. 0.50 - 0.25mm						
.. .. 0.25 - 0.10mm						
.. .. 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30cm) Laboratory no.12733 / 79

			Available	Total
pH-H_2O (1: 2½v/v)	8.3		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	2.66	
C%	0.51	K ..	0.28	
N%	-	Ca ..	28.4	
P-Olsen(ppm)		Mg ..	7.0	
		Mn ..	0.22	
		P (ppm)	12	

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 32 Continued

ELDOBSERVATION No: 155-91 MAPPING UNIT: Pa 2.13 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12870	12871				
Horizon	C	C				
Depth (cm)	145–170	170–224				
pH–H_2O(1:2½ v/v)	8.5	–				
pH–KCl ..						
EC(mmho/cm) ..	3.5	–				
$CaCO_3$(%)	2.1	2.0				
$CaSO_4$(%)	0.6	0.8				
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	53.4	51.4				
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	12.5	14.7				
.. Mg ..	–	–				
.. K ..	0.2	0.2				
.. Na ..	20.2	23.4				
Sum of cations	–	–				
Base sat. %, pH 8.2	–	–				
.. .. %, pH 7.0						
ESP at pH 8.2	38	46				
Saturation extract:						
oisture %	127	140				
H–paste	7.4	7.5				
Ce (mmho/cm)	10.0	8.5				
a (me/l)	80.0	72.0				
..	0.10	0.10				
a ..	11.5	7.5				
g ..	9.6	6.3				
m of cations(me/l)	101	86				
O_3(me/l)	0	0				
O_3 ..	7.8	8.4				
..	90.0	75.0				
4 ..	1.9	1.5				
n of anions(me/l)	100	85				
SAR	25	27				
lay mineralogy:						
$_2/Al_2O_3$(mol/mol)						
$_2/R_2O_3$ ..						
O_3(mmol%)						

ay report:

Depth (cm)	145–170	170–224				
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	22	24				
Silt % 0.05–0.002mm	10	10				
Clay % 0.002–0 mm	68	66				
Texture class	C	C				
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm) Laboratory no. /

			Available	Total
pH–H_2O (1: v/v)				
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 790/0

Profile description no. 33

Observation/date : 155-93; Garissa district (Bura East project area); 11-9-79

Soil classification : orthic SOLONETZ

Mapping unit : Ps 2.13

Parent material : Marine/lacustrine sediments

Physiography : Sedimentary plain

Slope : Less than 0.5%

Vegetation : Chrysopogon aucheri, Schoenefeldia transiens, Combretum hereroense, Grewia tenax; bushed grassland

Salinity/sodicity : Moderately saline from 40cm and strongly saline from 75cm; strongly sodic from 10cm

Surface sealing : 2mm thick, moderate

Drainage class : Imperfectly drained

A 0-10cm — Very dark grey (10YR 4/1 dry, 10YR 3/1 moist); sandy clay; moderate, medium to coarse, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; calcareous; common fine and few medium pores; many, very fine and fine roots; pH-H_2O = 9.0; clear and smooth transition to:
(sample no. 155-93a)

Bt1 10-40cm — Dark grey (10YR 4/1 moist); clay; moderate, coarse to very coarse, prismatic structure breaking into weak coarse, angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; calcareous; few, fine pores; few very fine and common fine and medium roots; pH-H_2O = 9.1; gradual and smooth transition to:
(sample no. 155-93b)

Bt2 40-75cm — Dark greyish brown (10YR 4/2 moist); clay; moderate, coarse, angular blocky structure; firm when moist, sticky and plastic when wet; continuous, moderately thick clayskins, calcareous; few, very fine pores; few, fine and medium roots; pH-H_2O = 8.0; gradual and wavy transition to:
(sample no. 155-93c)

Btk 75-120cm — Grey (10YR 5/1 moist); clay; weak, medium to coarse, angular blocky structure; firm when moist, sticky and plastic when wet; broken, thin clayskins; calcareous; about 5% soft powdery lime; few, very fine, pores, very few, medium roots; pH-H_2O = 8.0;
(sample no. 155-93d)

BCy	120-162cm	Light grey to grey (10YR 6/1 moist); clay; sticky and plastic when wet; slightly calcareous; some soft powdery lime and about 15% gypsum crystals; pH-H_2O = 7.9; (sample no. 155-93e)
BCz	162-183cm	Dark greyish brown (10YR 4/2 moist); clay; sticky and plastic when wet; slightly calcareous; many salt crystals; pH-H_2O=8.0; (sample no. 155-93f)
C	183-232cm	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; non-calcareous; pH-H_2O = 7.9 (sample no. 155-93g)

Note: 1) Cracks extend from the surface to about 40cm depth.

2) Profile was augered from 120cm onwards.

LABORATORY DATA OF PROFILE DESCRIPTION No: 33

IELD OBSERVATION No: 155-93 MAPPING UNIT: Ps 2.13 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ..... /79	12911	12912	12913	12914	12915	12916
Horizon	A	Bt1	Bt2	Btk	BCy	BC2
Depth (cm)	0-10	10-40	40-75	75-120	120-162	162-183
pH-H_2O (1: 2½ v/v)	8.6	9.0	8.3	8.1	8.0	8.0
pH-KCl ,,						
EC (mmho/cm) ,,	0.40	0.70	4.5	7.0	6.5	7.5
$CaCO_3$ (%)	1.8	2.1	1.8	2.4	2.1	1.9
$CaSO_4$ (%)	tr	tr	tr	tr	tr	tr
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	32.5	34.6	33.4	49.0	49.8	41.4
CEC ,, ,, pH 7.0						
Exch.Ca (me/100g)	48.1	20.2	16.2	25.7	29.7	18.2
,, Mg ,,	1.6	-	-	-	-	-
,, K ,,	1.5	0.4	0.5	0.5	0.3	0.5
,, Na ,,	2.6	5.4	5.8	10.6	10.6	17.3
Sum of cations	54	-	-	-	-	-
Base sat. %, pH 8.2	100+	-	-	-	-	-
,, ,, %, pH 7.0						
ESP at pH 8.2	8	16	18	22	21	42
Saturation extract:						
Moisture %	61	98	88	87	97	99
pH-paste	8.1	8.1	7.3	7.3	7.2	7.5
ECe (mmho/cm)	0.70	0.35	12.5	18.0	18.0	17.5
Na (me/l)	1.50	1.50	84.0	120	120	115
K ,,	0.17	0.18	0.20	0.15	0.15	0.18
Ca ,,	4.00	2.00	27.5	38.0	41.0	39.0
Mg ,,	2.38	0.63	14.2	22.1	20.8	19.2
Sum of cations (me/l)	8.0	4.3	126	180	182	173
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ,,	5.80	2.00	8.00	7.99	8.05	8.72
Cl ,,	1.00	1.00	117	163	163	155
SO_4 ,,	0.94	0.94	0.94	9.40	9.40	9.40
Sum of anions (me/l)	7.7	3.9	126	180	180	173
SAR	1	1	18	22	22	21
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ,,						
Fe_2O_3 (mmol%)						

X-ray report:

Depth (cm)	0-10	10-40	40-75	75-120	120-162	162-183
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	48	48	36	30	32	26
Silt % 0.05-0.002mm	6	4	6	4	2	2
Clay % 0.002-0 mm	46	48	58	66	66	72
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
,, ,, 1.0 - 0.50mm						
,, ,, 0.50 - 0.25mm						
,, ,, 0.25 - 0.10mm						
,, ,, 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30cm) Laboratory no.12728 / 79

			Available	Total
pH-H_2O (1: 2½ v/v)	8.4			
Exch. acidity (me/100g)	-	Na (me/100g)	2.11	
C%	0.83	K ,,	0.26	
N%	-	Ca ,,	25.9	
P-Olsen (ppm)		Mg ,,	6.8	
		Mn ,,	0.09	
		P (ppm)	12	

Various:

Remarks:

LABORATORY DATA OF PROFILE DESCRIPTION No: 33 Continued

ELD OBSERVATION No: 155-93 MAPPING UNIT: Ps 2.13 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../79	12917				
Horizon	C				
Depth (cm)	183–230				
pH–H_2O (1: 2½ v/v)	8.2				
pH–KCl ..					
EC (mmho/cm) ..	5.5				
$CaCO_3$ (%)	1.6				
$CaSO_4$ (%)	tr				
C (%)					
N (%)					
C/N					
CEC (me/100g), pH 8.2	34.6				
CEC .. .. pH 7.0					
Exch. Ca (me/100g)	10.6				
.. Mg ..	–				
.. K ..	0.6				
.. Na ..	17.2				
Sum of cations	–				
Base sat. %, pH 8.2	–				
.. .. %, pH 7.0					
ESP at pH 8.2	50				
Saturation extract:					
Moisture %	114				
pH–paste	7.4				
ECe (mmho/cm)	18.0				
Na (me/l)	140				
..	0.15				
a ..	24.0				
g ..	15.0				
Sum of cations (me/l)	179				
O_3 (me/l)	0				
CO_3 ..	7.80				
..	168				
4 ..	4.70				
Sum of anions (me/l)	181				
SAR	32				
Clay mineralogy:					
O_2/Al_2O_3 (mol/mol)					
O_2/R_2O_3 ..					
$_2O_3$ (mmol%)					
X-ray report:					

Depth (cm)	183–230					
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	20					
Silt % 0.05–0.002mm	10					
Clay % 0.002–0 mm	70					
Texture class	C					
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH–H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P–Olsen (ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Profile description no. 34

Observation/date	: 155-90, Garissa district, Bura East project area; 11/9/79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 2.14
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Sporobolus helvolus, Schoenefeldia transiens, Combretum hereroense; bushed grassland.
Salinity/sodicity	: Moderately saline from 58cm, strongly saline from 80cm and strongly sodic from 24cm onwards
Surface sealing	: 1-3mm thick, moderate
Drainage class	: Imperfectly drained

A 0-8cm Very dark greyish brown (10YR 3/2 dry and moist); sandy clay; moderate, very fine and fine crumby structure and weak, fine to medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; many, very fine pores; many very fine and fine and few medium roots; pH-H_2O = 8.9; clear and wavy transition to:
(sample no. 155-90a)

BA 8-24cm Dark brown (10YR 3/3 moist); clay; weak, medium to coarse, prismatic structure breaking into moderate, fine and medium, subangular blocky; very hard when dry, firm when moist, sticky and plastic when wet; no cutans; strongly calcareous; common very fine and fine and few medium pores; common very fine and fine, few medium roots; pH-H_2O = 8.9; gradual and smooth transition to:
(sample no. 155-90b)

Bt 24-58cm Dark brown (10YR 3/3 moist); clay; weak, coarse, prismatic structure firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; few, very fine pores; few, very fine and fine roots; pH-H_2O = 8.7; clear and smooth transition to:
(sample no. 155-90c)

Btk 58-80cm Dark brown (10YR 3/3 moist); clay; moderate, medium, angular blocky structure; friable when moist, sticky and plastic when wet; broken, thin clayskins; strongly calcareous; about 2% soft powdery lime; common, very fine and fine pores; very few, very fine (dead) roots; pH-H_2O = 8.0; gradual and smooth transition to:
(sample no. 155-90d)

BCky	80-100cm	Dark grey (10YR 4/1 moist); clay; moderate, fine to medium, angular blocky structure; friable when moist, sticky and plastic when wet; common, moderate pressure faces; no cutans; strongly calcareous; about 3% soft powdery lime and 10% gypsum crystals; many, very fine pores; very few, very fine, dead roots; pH-H_2O = 8.0; gradual and smooth transition to: (sample no. 155-90e)
Cky1	100-190cm	Greyish brown (10YR 5/2 moist); clay; moderate, fine to medium, subangular blocky structure; friable when moist, sticky and plastic when wet; common, moderate pressure faces; no cutans; strongly calcareous; about 5% soft powdery lime and 10% gypsum; few, very fine pores; no roots observed; pH-H_2O = 7.8 (sample no. 155-90f and g)
Cky2	190-240cm (augered)	Greyish brown (10YR 5/2 moist); clay; sticky and plastic when wet; calcareous; about 5% soft powdery lime and 30% gypsum; pH-H_2O = 8.2 (sample no. 155-90h)

LABORATORY DATA OF PROFILE DESCRIPTION No: 34

LD OBSERVATION No: 155-90 MAPPING UNIT: Ps 2.14 SOIL CLASSIFICATION: orthic SOLONETZ

aboratory no. ..... / 79	12872	12873	12874	12875	12876	12877
orizon	A	BA	Bt	Btk	BCky	Cky1
epth (cm)	0-8	8-24	24-58	58-80	80-100	100-160
H-H_2O(1:2½ v/v)	8.0	8.9	8.9	8.1	8.2	8.1
H-KCl ,,						
C(mmho/cm) ,,	1.5	2.0	1.3	3.5	4.0	5.0
aCO_3(%)	2.0	2.1	1.8	1.8	2.0	2.0
aSO_4(%)	0.1	0.1	0.1	0.1	0.2	0.8
(%)						
(%)						
/N						
EC (me/100g), pH 8.2	47.5	33.0	39.0	39.8	44.6	39.8
EC ,, ,, pH 7.0						
xch.Ca (me/100g)	50.2	50.2	31.2	20.7	32.7	-
,, Mg ,,	1.5	1.8				
,, K ,,	1.4	0.8	0.2	0.4	0.3	-
,, Na ,,	1.4	2.7	6.1	14.2	18.0	-
um of cations	55	56				
ase sat. %, pH 8.2	100+	100+				
,, ,, %, pH 7.0						
SP at pH 8.2	4	7	15	32	45	-
Saturation extract:						
oisture %	71	73	71	71	84	126
H-paste	7.5	8.0	8.2	7.4	7.5	7.4
Ce (mmho/cm)	1.4	0.90	0.60	12.0	13.0	13.5
a(me/l)	6.0	7.3	3.6	90.0	60.5	65.0
,,	0.10	0.03	0.06	0.21	0.31	0.15
a ,,	6.0	0.50	1.0	6.5	38.5	39.5
g ,,	2.50	1.25	1.25	22.5	30.8	28.3
m of cations(me/l)	14.6	8.9	5.9	119	130	133
O_3(me/l)	0	-	-	0	0	0
CO_3 ,,	8.0	-	-	7.6	8.0	7.5
,,	3.0	-	-	105	113	118
4 ,,	3.4	-	-	6.9	7.6	8.7
m of anions(me/l)	14.4	-	-	120	129	134
SAR	3	8	3	24	10	11
Clay mineralogy:						
$_2$/Al_2O_3(mol/mol)						
$_2$/R_2O_3 ,,						
$_2O_3$(mmol%)						

ray report: A, BA and Bt horizons: Montmorillonite of good crystallization.

Depth (cm)	0-8	8-24	24-58	58-80	80-100	100-160
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	46	44	38	40	38	32
Silt % 0.05–0.002mm	4	8	6	2	2	6
Clay % 0.002–0 mm	50	48	56	58	60	62
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
,, ,, 1.0 – 0.50mm						
,, ,, 0.50 – 0.25 mm						
,, ,, 0.25 – 0.10mm						
,, ,, 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–20cm) Laboratory no. 12731/79

			Available	Total
pH-H_2O (1: 2½ v/v)	8.5		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	1.38	
C%	0.74	K ,,	0.44	
N%	-	Ca ,,	22.4	
P-Olsen (ppm)		Mg ,,	5.9	
		Mn ,,	0.39	
		P (ppm)	12	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79000

LABORATORY DATA OF PROFILE DESCRIPTION No: 34 Continued.

OBSERVATION No: 155-90 MAPPING UNIT: Ps 2.14 SOIL CLASSIFICATION: orthic SOLONETZ

oratory no. ...../79	12878	12879				
izon	Cky1	Cky2				
th (cm)	160-190	190-240				
-H_2O(1:2½ v/v)	8.0	8.9				
-KCl ..						
(mmho/cm) ..	5.0	5.0				
CO_3 (%)	2.2	0.9				
O_4(%)	0.3	0.6				
%)						
%)						
C (me/100g), pH 8.2	43.0	51.4				
C .. .. pH 7.0						
h.Ca (me/100g)	18.2	13.6				
Mg ..						
K ..	0.3	0.4				
Na ..	17.5	21.1				
of cations						
e sat. %, pH 8.2						
.. %, pH 7.0						
at pH 8.2	41	41				
turation extract:						
sture %	85	97				
-paste	7.3	7.4				
(mmho/cm)	12.5	10.5				
me/l)	58.0	120				
..	0.10	0.28				
..	35.5	29.0				
..	20.8	17.9				
of cations(me/l)	114	167				
(me/l)	0	-				
$_3$ ..	7.2	-				
..	110	-				
..	7.2	-				
of anions(me/l)	124	-				
SAR	11	-				
y mineralogy:						
/Al_2O_3(mol/mol)						
/R_2O_3 ..						
$_3$(mmol%)						
y report:						

Depth (cm)	160-190	190-240				
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	38	34				
Silt % 0.05–0.002mm	2	10				
Clay % 0.002–0 mm	60	56				
Texture class	C	C				
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						
Fertility aspects: (0– cm)			Laboratory no. /			
pH–H_2O (1: v/v)					Available	Total
Exch. acidity (me/100g)			Na (me/100g)			
C%			K ..			
N%			Ca ..			
P–Olsen (ppm)			Mg ..			
			Mn ..			
			P (ppm)			
Various:						

Remarks:

Profile description no. 35

Observation/date : 141-7; Garissa district, Bura East project/1-8-79
Soil classification : haplic XEROSOL
Mapping unit : Ps 2.15
Parent material : Marine/lacustrine sediments
Physiography : Sedimentary plain
Slope : Less than 0.5%
Vegetation : Sporobolus helvolus, Chrysopogon aucheri, Indigofera schimperi, Grewia tenax; dwarf shrub grassland

Salinity/sodicity : Non-saline; moderately sodic from 36cm and strongly sodic from 80cm
Drainage class : Imperfectly drained

A 0-5cm Dark greyish brown (10YR 4/2 dry/moist); sandy clay; massive with tendency to weak, medium to coarse, subangular blocky structure; many micro and very fine, few fine pores; few fine roots; pH-H_2O = 7.8; abrupt and wavy transition to:

(sample no. 141-7a)

AB 5-36cm Dark grey (10YR 4/1 moist); sandy clay; weak, very fine and fine subangular blocky structure; friable when moist, sticky and plastic when wet; strongly calcareous; many micro and very fine, few fine pores; many, very fine and fine roots; pH-H_2O = 8.0; gradual and smooth transition to:

(sample no. 141-7b)

Bt1 36-80cm Dark grey (10YR 4/1 moist); clay; moderate, fine prismatic structure breaking to weak, fine to medium, angular blocky; firm when moist, sticky and plastic when wet; patchy, thin clayskins; few, weak slickensides; strongly calcareous; few, very fine to medium pores; common medium, few coarse roots; pH-H_2O = 8.8; diffuse and smooth transition to:

(sample no. 141-7c)

Bt2 80-170cm Dark greyish brown (10YR 4/2 moist); clay; moderate, very fine to fine angular blocky structure; firm when moist, sticky and plastic when wet; broken, moderately thick clayskins; strongly calcareous; common very fine and fine, few medium pores; few, very fine and fine roots; pH-H_2O = 9.4 (sample no. 141-7d)

C 170-230cm Brown (10YR 5/3 moist); clay; sticky and plastic when wet; strongly (augered) calcareous

LABORATORY DATA OF PROFILE DESCRIPTION No: 35

OBSERVATION No: 141-7 MAPPING UNIT: Ps 2.15 SOIL CLASSIFICATION: haplic XEROSOL

oratory no......../79	11654	11655	11656	11657		
izon	A	AB	Bt1	Bt2		
th (cm)	0-5	5-36	36-80	80-170		
H_2O(1: 2½ v/v)	8.1	8.4	9.0	9.7		
KCl ..	6.7	7.0	7.5	8.1		
mmho/cm) ..	0.14	0.18	0.35	0.35		
O_3(%)						
O_4(%)	tr	tr	tr	tr		
)	0.74	0.47	0.36	0.47		
)						
(me/100g), pH 8.2	36.0	34.8	30.4	36.4		
.. .. pH 7.0						
h.Ca (me/100g)	23.0	38.0	36.0	24.0		
Mg ..	5.0	4.3	12.6	14.4		
K ..	1.5	1.5	1.1	1.1		
Na ..	1.7	1.2	4.2	13.3		
of cations	31	45	54	53		
sat. %, pH 8.2	87	100+	100+	100+		
.. %, pH 7.0						
at pH 8.2	5	3	14	37		
uration extract:						
ture %						
paste						
(mmho/cm)						
e/l)						
..						
..						
..						
of cations(me/l)						
me/l)						
..						
..						
..						
f anions(me/l)						
AR						
y mineralogy:						
Al_2O_3(mol/mol)						
R_2O_3 ..						
(mmol%)						
report:						

Depth (cm)	0-5	5-36	36-80	80-170		
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	54	48	46	44		
Silt % 0.05–0.002mm	4	4	0	2		
Clay % 0.002–0 mm	42	48	54	54		
Texture class	SC	SC	C	C		
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 30cm) Laboratory no. 11676 / 79

			Available	Total
pH–H_2O (1: 2½ v/v)	8.3		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	0.44	
C%	0.41	K ..	0.66	
N%	-	Ca ..	27.6	
P–Olsen (ppm)		Mg ..	8.6	
		Mn ..	0.38	
		P (ppm)	34	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 36

Observation/date	: 155-75, Garissa district, Bura East irrigation project; 21/8/79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.15
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Sporobolus helvolus, Indigofera schimperi; dwarf shrub grassland
Salinity/sodicity	: Moderately saline from 46cm and strongly saline from 72cm; strongly sodic from 12cm
Surface sealing	: 2mm thick, strong
Drainage class	: Poorly drained

A 0-12cm Dark greyish brown (10YR 5/1 dry, 10YR 4/2 moist); sandy clay; moderate, fine and medium, subangular blocky structure and weak, fine, crumby structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many, very fine and fine pores; common, very fine and fine (some dead) roots; pH-H_2O=8.1; clear and wavy transition to:

(sample no. 155-75a)

Bt 12-46cm Dark greyish brown (10YR 4/2 moist); clay; moderate, coarse and very coarse, prismatic structure breaking into weak, fine to coarse, angular and subangular blocky; hard when dry, firm when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; common very fine, few fine pores; few, very fine roots; pH-H_2O= 8.9; clear and smooth transition to:

(sample no. 155-75b)

Bk 46-72cm Brown to dark brown (10YR 4/3 moist); clay; moderate, fine and medium, angular blocky structure; firm when moist, sticky and plastic when wet; no cutans observed; strongly calcareous; about 5% soft powdery lime; common, very fine pores; very few, very fine roots; pH-H_2O=7.9; clear and smooth transition to:

(sample no. 155-75c)

Bw 72-125cm Brown to dark brown (10YR 4/3 moist); clay; moderate, fine and medium, angular blocky structure; friable when moist, sticky and plastic when wet; few, weak slickensides; strongly calcareous; few, very fine pores; very few, very fine roots; pH-H_2O = 8.3;

(sample no. 155-75d)

BC	125-165cm (augered)	Greyish brown (10YR 5/2 moist); clay; sticky and plastic when wet; calcareous; pH-H_2O = 7.9 (sample no. 155-75e)
C	165-200cm (augered)	Grey (10YR 5/1 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 8.0 (sample no. 155-75f)

LABORATORY DATA OF PROFILE DESCRIPTION No: 36

ELD OBSERVATION No: 155-75 MAPPING UNIT: Ps 2.15 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ...../79	12231	12232	12233	12234	12235	12236
Horizon	A	Bt	Bk	Bw	BC	C
Depth (cm)	0–12	12–46	46–72	72–125	125–165	165–200
$pH-H_2O$ (1: 2½ v/v)	8.5	8.5	8.2	8.4	8.1	8.3
pH–KCl ..						
EC (mmho/cm) ..	0.30	1.4	5.5	7.0	8.5	8.0
$CaCO_3$ (%)						
$CaSO_4$ (%)	tr	tr	tr	tr	1.2	1.4
C (%)	0.62	0.41	0.24	0.21	0.18	0.12
N (%)						
C/N						
CEC (me/100g), pH 8.2	39.0	33.0	39.0	39.0	40.0	50.0
CEC .. .. pH 7.0						
Exch. Ca (me/100g)	49.0	62.5	95.0	77.0	91.0	28.0
.. Mg ..	8.1	12.1	13.4	16.9	10.9	14.6
.. K ..	1.5	1.0	1.2	1.5	1.3	1.2
.. Na ..	1.2	5.6	16.8	22.1	19.3	23.3
Sum of cations	60	81	126	116	123	57
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
.. .. %, pH 7.0						
ESP at pH 8.2	3	17	43	57	48	47
Saturation extract:						
Moisture %	57	71	94	101	100	131
pH–paste	6.9	7.3	7.1	7.3	7.2	7.4
ECe (mmho/cm)	0.5	1.0	14.0	19.5	18.0	17.0
Na (me/l)	1.50	7.50	99.0	145	130	140
K ..	0.28	0.08	0.36	0.36	0.28	0.23
Ca ..	3.00	1.00	20.5	24.0	29.5	14.5
Mg ..	0.83	0.83	18.8	25.0	19.5	15.0
Sum of cations (me/l)	5.6	9.4	139	194	179	170
CO_3 (me/l)	0	0	0	0	0	0
HCO_3 ..	1.4	2.4	24.0	20.0	14.0	24.0
Cl ..	3.60	5.00	100	163	155	137
SO_4 ..	0.95	1.88	14.2	10.8	9.90	6.96
Sum of anions (me/l)	6.0	9.3	138	194	179	168
SAR	1	8	22	29	26	36
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X–ray report: A and Bt horizons: Mainly montmorillonite of good crystallization and traces of illite.

Depth (cm)	0–12	12–46	46–72	72–125	125–165	165–200
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	46	44	40	32	32	24
Silt % 0.05–0.002mm	10	8	6	0	6	8
Clay % 0.002–0 mm	44	48	54	68	62	68
Texture class	SC	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25 mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0–30cm) Laboratory no. 12254/ 79

			Available	Total
$pH-H_2O$ (1: 2½ v/v)	8.1			
Exch. acidity (me/100g)	–	Na (me/100g)	1.45	
C%	0.56	K ..	0.21	
N%	–	Ca ..	28.8	
P–Olsen (ppm)		Mg ..	6.6	
		Mn ..	0.15	
		P (ppm)	15	

Various:

Remarks:

Profile description no. 37

Observation	: 155-76; Garissa district, Bura East irrigation project; 21/3/79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.15
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Sporobolus helvolus, Combretum hereroense; bushed grassland
Salinity/sodicity	: Saline and sodic from 40cm
Surface sealing	: 2mm thick, weak
Drainage class	: Imperfectly drained

A 0-10cm Dark grey (10YR 5/1 dry, 10YR 4/1 moist); clay; weak, medium and coarse, subangular blocky structure breaking into weak, medium, crumby structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many, very fine and fine pores; common very fine and fine, few medium roots; pH-H_2O = 7.9; clear and wavy transition to:

(sample no. 155-76a)

Bt1 10-70cm Brown to dark brown (10YR 5/1 dry, 10YR 4/3 moist); clay; moderate, coarse to very coarse, prismatic structure breaking into weak, fine and medium, angular blocky; hard when dry, firm when moist, sticky and plastic when wet; broken, moderately thick clayskins and few, weak slickensides; common, very fine and fine pores; very few coarse, few very fine and fine roots; pH-H_2O = 7.9; clear and smooth transition to:

(sample nos 155-76b and c)

Bt2 70-160cm Brown to dark brown(10YR 4/3 moist); clay; weak, medium to coarse, angular blocky structure; friable when moist, sticky and plastic when wet; patchy, thin clayskins and common, moderate slickensides; calcareous; few, very fine and fine pores; very few, very fine roots; pH-H_2O = 7.9;

(sample nos. 155-76 d and e)

C 160-200cm (augered) Grey (10YR 5/1 moist); clay; sticky and plastic when wet; slightly calcareous; pH-H_2O = 7.9

(sample no. 155-76f)

LABORATORY DATA OF PROFILE DESCRIPTION No: 37

ELD OBSERVATION No: 155-76   MAPPING UNIT: Ps 2.15   SOIL CLASSIFICATION:- haplic XEROSOL

Laboratory no. ...../79	12237	12238	12239	12240	12241	12242
Horizon	A	Bt1	Bt1	Bt2	Bt2	C
Depth (cm)	0-10	10-40	40-70	70-110	110-160	160-200
pH-H_2O(1: 2½ v/v)	8.3	7.9	7.9	8.1	8.2	8.4
pH-KCl „						
EC(mmho/cm) „	0.50	2.0	3.5	5.0	8.5	9.0
$CaCO_3$ (%)						
$CaSO_4$(%)	0.1	0.1	0.1	0.2	0.2	0.4
C (%)	0.77	0.30	0.27	0.27	0.21	0.27
N (%)						
C/N						
CEC (me/100g). pH 8.2	37.0	34.0	31.8	39.0	45.0	37.0
CEC „ „ pH 7.0						
Exch.Ca (me/100g)	56.0	65.0	51.5	23.0	71.0	48.0
„ Mg „	2.4	3.9	3.5	16.1	15.4	17.8
„ K „	1.7	0.7	1.2	1.3	1.2	1.1
„ Na „	1.1	1.5	4.7	14.1	21.1	19.5
Sum of cations	61	71	61	55	109	86
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
„ „ %, pH 7.0						
ESP at pH 8.2	3	4	15	36	47	53
Saturation extract:						
Moisture %	66	71	80	89	94	162
pH-paste	7.6	7.0	6.7	6.8	7.0	7.5
ECe (mmho/cm)	1.3	2.1	5.5	13.0	17.0	19.0
Na(me/l)	4.78	5.50	26.0	80.0	119	141
K „	0.28	0.18	0.23	0.23	0.36	0.36
Ca „	8.00	13.0	20.0	23.0	24.5	21.0
Mg „	1.25	2.08	8.75	25.4	26.3	27.1
Sum of cations(me/l)	14.3	20.8	55.0	129	170	189
CO_3(me/l)	0	0	0	0	0	0
HCO_3 „	22.0	16.0	16.0	22.0	26.0	20.0
Cl „	12.1	25.0	32.0	96.0	132	159
SO_4 „	1.88	1.88	7.99	10.8	10.8	9.35
Sum of anions(me/l)	36.0	42.9	56.0	129	169	188
SAR	2	2	7	16	24	29
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 „						
Fe_2O_3(mmol%)						

X-ray report:

Depth (cm)	0-10	10-40	40-70	70-110	110-160	160-200
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 - 0.05 mm	42	42	44	36	24	20
Silt % 0.05-0.002mm	8	8	6	2	14	8
Clay % 0.002-0 mm	50	50	50	62	62	72
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 - 1.0mm						
„ „ 1.0 - 0.50mm						
„ „ 0.50 - 0.25 mm						
„ „ 0.25 - 0.10mm						
„ „ 0.10 - 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0-30 cm)   Laboratory no. 12255/ 79

			Available	Total
pH-H_2O (1: 2½ v/v)	7.9		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	0.63	
C%	0.59	K „	0.33	
N%	-	Ca „	30.0	
P-Olsen(ppm)		Mg „	4.3	
		Mn „	0.17	
		P (ppm)	17	

Various:

Remarks:

Profile description no. 38

Observation/date	: 155-52, Garissa district, Bura East Project/15-3-79
Soil classification	: haplic XEROSOL
Mapping unit	: Ps 2.16
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Tetrapogon tenellus, Chrysopogon aucheri, Grewia tenax, Cordia sinensis; bushed grassland.
Salinity/sodicity	: Slightly saline from 80cm and strongly saline from 115cm; moderately sodic from 40cm and strongly sodic from 80cm
Surface sealing	: Weak sealing, 1mm thick
Drainage class	: Moderately well drained

A 0-15cm Dark brown (7.5YR 4/4 dry, 7.5YR 3.5/3 moist); clay; weak, very fine and fine crumby and weak, very fine subangular blocky structure; soft when dry, very friable when moist, sticky and plastic when wet; strongly calcareous; many very fine, few fine pores; many very fine roots; pH-H_2O = 7.6; clear and wavy transition to:

(sample no. 155-52a)

Bt 15-40cm Dark brown (7.5YR 3.5/3 dry, 7.5YR 3/2 moist); clay; weak, coarse to very coarse, prismatic structure with tendency to weak, very fine and fine, angular and subangular blocky; slightly hard when dry, friable when moist, sticky and plastic when wet; patchy, thin clayskins; strongly calcareous; 1-2% small $CaCO_3$ concretions; many very fine, few fine and medium roots; pH-H_2O = 7.8; clear and wavy transition to:

(sample no. 155-52b)

Btkl 40-80cm Dark brown (7.5YR 3/2 dry/moist); clay; moderate, medium to coarse prismatic with tendency to weak, fine angular blocky; hard when dry, firm when moist, sticky and plastic when wet; continuous, moderately thick clayskins; strongly calcareous; some soft lime and 2-3% small $CaCO_3$ concretions; common very fine, few fine and medium pores; common very fine, few fine and medium roots; pH-H_2O = 7.9; clear and smooth transition to:

(sample no. 155-52c)

Btk2	80-115cm	Dark brown (7.5YR 3.5/3 moist); clay; moderate, medium to coarse, prismatic structure with tendency to weak, fine angular blocky; hard when dry, firm when moist, sticky and plastic when wet; continuous, moderately thick clayskins; strongly calcareous; some soft lime and about 1% small $CaCO_3$, concretions; few to common, very fine pores; few, very fine roots; pH-H_2O = 8.2; gradual and smooth transition to: (sample no. 155-52d)
Btz	115-150cm	Grey (7.5YR 4/4 to 10YR 4/3 dry, 10YR 5/1 moist); clay; weak, coarse to very coarse, prismatic structure; friable to firm when moist, sticky and plastic when wet; continuous, moderately thick clayskins; strongly calcareous; many salt crystals; few to common, very fine pores; very few, very fine roots; pH-H_2O= 8.0 (sample no. 155-52e)

LABORATORY DATA OF PROFILE DESCRIPTION No: 38

ELD OBSERVATION No: 155-52 MAPPING UNIT: Pe 2.16 SOIL CLASSIFICATION: haplic XEROSOL

Laboratory no. ..... /79	4998	4999	5000	5001	5002	
Horizon	A	Bt	Btk1	Btk2	Btz	
Depth (cm)	0-15	15-40	40-80	80-115	115-150	
pH-H_2O(1: 2½ v/v)	8.6	8.6	8.9	8.6	8.3	
pH-KCl ..	7.3	7.3	7.6	7.5	7.3	
EC(mmho/cm) ..	0.26	0.20	0.27	1.7	7.5	
$CaCO_3$ (%)	2.5	4.2	5.2	4.5	4.5	
$CaSO_4$ (%)	tr	tr	tr	tr	tr	
C (%)						
N (%)						
C/N						
CEC (me/100g), pH 8.2	27.9	27.4	25.6	23.8	27.0	
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	59.0	61.2	47.5	58.0	84.0	
.. Mg ..	1.1	1.4	2.1	2.5	3.1	
.. K ..	3.3	1.8	1.7	2.5	2.0	
.. Na ..	1.2	1.5	3.2	14.1	19.3	
Sum of cations	65	66	55	77	108	
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	
.. .. %, pH 7.0						
ESP at pH 8.2	4	5	12	60	72	
Saturation extract:						
Moisture %				86	71	
pH-paste				7.8	7.2	
Ece (mmho/cm)				6.0	30.0	
(me/l)					236	
..					0.26	
..					28.2	
..					36.2	
Sum of cations(me/l)					301	
3 (me/l)					-	
O_3 ..					29.0	
..					254	
..					15.0	
Sum of anions(me/l)					298	
SAR					42	
Clay mineralogy:						
$/Al_2O_3$(mol/mol)						
$/R_2O_3$ ..						
O_3(mmol%)						

Clay report: A and Bt horizons: Mainly amorphous material, with very
slight traces of illite.

Depth (cm)	0-15	15-40	40-80	80-115	115-150	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	44	42	43	38	34	
Silt % 0.05–0.002mm	6	8	6	10	4	
Clay % 0.002–0 mm	50	50	51	52	62	
Texture class	C	C	C	C	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 20 cm) Laboratory no.4857 / 79

			Available	Total
pH-H_2O (1:2½ v/v)	8.1			
Exch.acidity (me/100g)	-	Na (me/100g)	0.58	
C%	0.67	K ..	1.04	
N%	-	Ca ..	24.5	
P-Olsen (ppm)		Mg ..	6.6	
		Mn ..	0.40	
		P (ppm)	22	

Various:

Remarks:

Profile description no. 39

Observation/date : 155-50, Garissa district, Bura East project/15-3-79
Soil classification : luvic XEROSOL
Mapping unit : Ps 2.17
Parent material : Marine/lacustrine sediments
Physiography : Sedimentary plain
Slope : Less than 0.5%
Vegetation : Dactyloctenium scindicum, Tetrapogon tenellus, Acàcia reficiens, Commiphora riparia, Indigofera schimperi, Sansevieria raffillii; bushed grassland
Salinity/sodicity : Slightly saline from 50cm and strongly saline from 106cm; strongly sodic from 50cm
Surface sealing : Nil
Drainage class : Moderately well drained

A 0-12cm Brown to dark brown (7.5YR 4.5/4 dry, 7.5YR 4/4 moist); sandy loam; massive; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; many, very fine pores; many, very fine roots; pH-H_2O = 6.0; abrupt and wavy transition to:
(sample no. 155-50a)

Bt1 12-55cm Dark red (2.5YR 3/6 dry/moist); sandy clay; moderate, medium to coarse, prismatic structure with tendency to weak to moderate, medium to coarse, angular blocky; hard when dry, firm when moist, sticky and plastic when wet; broken, thin clayskins; many very fine, few fine and medium pores; many very fine, common fine, few medium roots; pH-H_2O = 6.0; clear and wavy transition to:
(sample no. 155-50b)

Bt2 55-80cm Reddish brown (5YR 5/6 - 7.5YR 5/6 dry, 5YR 4/4 moist); sandy clay; weak, medium to coarse, prismatic structure with tendency to weak, fine to medium, angular blocky; hard when dry, friable to firm when moist; slightly sticky and slightly plastic when wet; broken, thin clayskins; many very fine pores; common very fine roots; pH-H_2O = 7.4; clear and smooth transition to:
(sample no. 155-50c)

BC 80-106cm Brown (7.5YR 6/6 - 10YR 6/4 dry, 7.5YR 5/4 moist); sandy clay; weak, fine to medium, subangular blocky structure; slightly hard when dry, friable to firm when moist, slightly sticky and slightly plastic when wet; slightly calcareous; few, very fine pores; very few, fine roots; pH-H_2O = 7.8; diffuse and smooth transition to:
(sample no. 155-50d)

Cz	106-169cm	Yellowish brown (10YR 6/4 dry, 10YR 5/4 moist); clay; massive; slightly hard when dry, friable when moist, slightly sticky and slightly plastic when wet; moderately calcareous; many salt crystals; few, very fine pores; very few, very fine roots; pH-H_2O = 7.8 (sample no. 155-50e)

Note: A very thin, compact, bleached layer forms the upper part of the Btl horizon.

LABORATORY DATA OF PROFILE DESCRIPTION No: 39

LD OBSERVATION No: 155-50 MAPPING UNIT: Ps 2.17 SOIL CLASSIFICATION: luvic XEROSOL

aboratory no. ..... /79	4988	4989	4990	4991	4992	
orizon	A	Bt1	Bt2	BC	Cz	
epth (cm)	0-12	12-50	50-80	80-106	106-160	
H-H_2O(1:2.5 v/v)	7.2	7.7	8.4	8.5	8.2	
H-KCl ..	6.2	7.2	7.3	7.2	6.1	
C(mmho/cm) ..	0.07	0.40	1.3	1.6	3.5	
aCO_3(%)	0	0	0	1.8	1.3	
aSO_4(%)	0.1	0.1	0.2	0.2	0.2	
(%)	0.24	0.15	0.21	0.09	0.12	
(%)						
C/N						
CEC (me/100g), pH 8.2	7.5	21.3	27.0	25.2	24.3	
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	4.6	8.4	21.4	23.5	27.8	
.. Mg ..	1.7	11.0	1.8	1.7	2.1	
.. K ..	1.3	3.1	3.8	3.5	3.3	
.. Na ..	0.5	2.4	4.0	7.1	13.3	
Sum of cations	8	25	31	36	47	
Base sat. %, pH 8.2	100+	100+	100+	100+	100+	
.. .. %, pH 7.0						
ESP at pH 8.2	6	11	15	28	55	
Saturation extract:						
Moisture %			45	38	55	
pH-paste			7.5	7.3	7.2	
ECe (mmho/cm)			6.5	10.0	16.5	
Na (me/l)			46.0	78.0	-	
K ..			1.03	0.77	-	
Ca ..			8.0	13.4	-	
Mg ..			9.90	6.60	-	
Sum of cations(me/l)			65.2	98.8	-	
CO_3(me/l)			0	0	-	
HCO_3 ..			20.0	19.0	-	
Cl ..			42.0	-	-	
O_4 ..			1.17	-	-	
um of anions(me/l)			63.2	-	-	
SAR			15	29	-	
Clay mineralogy:						
SiO_2/Al_2O_3(mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3(mmol%)						

X-ray report: A and Bt1 horizons: Moderately crystallized illite is predominant, but grades into montmorillonite.

Depth (cm)	0-12	12-50	50-80	80-106	106-160	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	78	54	48	50	44	
Silt % 0.05–0.002mm	6	4	8	10	16	
Clay % 0.002–0 mm	16	42	44	40	40	
Texture class	SL	SC	SC	SC	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm) Laboratory no. /

pH-H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K ..		
N%		Ca ..		
P-Olsen(ppm)		Mg ..		
		Mn ..		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050

Profile description no. 40

Observation/date	: 155-51, Garissa District, Bura East Project/15-3-79
Soil classification	: orthic SOLONETZ
Mapping unit	: Ps 2.17
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Tetrapogon tenellus, Grewia tenax, Acacia reficiens, Sansevieria raffillii; bushed grassland.
Salinity/sodicity	: Moderately saline from 106cm
Surface sealing	: Weak sealing, 1-2mm thick
Drainage	: Imperfectly drained

0-15cm Dark grey (10YR 5/2 dry, 10YR 4/1 moist); clay; moderate, very fine to fine crumb and weak, very fine to fine, subangular blocky structure; slightly hard when dry, very friable when moist, sticky and plastic when wet; many very fine pores; abundant fine roots; pH-H_2O = 6.6; clear and wavy transition to:

(sample no. 155-51a)

tl? 15-30cm Dark greyish brown (10YR 5/3 dry, 10YR 4/2 moist); clay; moderate, medium prismatic structure with tendency to weak to moderate, medium to coarse, subangular and angular blocky; slightly hard to hard when dry, friable when moist, sticky and plastic when wet; common, very fine and fine pores; common, very fine and fine roots; pH-H_2O = 7.8; clear and wavy transition to:

(sample no. 155-51b)

t2 30-45cm Dark greyish brown (10YR 5/2 dry, 10YR 4/2 moist); clay; moderate, coarse to very coarse, prismatic structure with tendency to weak, moderate to coarse, angular blocky; hard when dry, friable when moist, sticky and plastic when wet; patchy, thin clayskins; common very fine, few very fine pores; common very fine, few fine roots; pH-H_2O = 7.8; clear and wavy transition to:

(sample no. 155-51c)

45-106cm Dark grey (10YR 4/2 dry, 10YR 4/1 moist); clay; moderate, very coarse prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; continuous, thick clayskins; slightly calcareous; few, very fine and fine pores; few, very fine and fine roots; pH-H_2O = 8.4; gradual and smooth transition to:

(sample no. 155-51d)

Bt4 106-160cm Dark greyish brown (10YR 5/2 dry, 10YR 4/2 moist); clay; weak, coarse prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; continuous, thick clayskins; slightly to moderately calcareous; few, very fine pores; few, very fine roots; pH-H_2O = 8.4;
(sample no. 155-51e)

Note: There is evidence of former, very deep cracks (more than 1m deep) now completely filled up.

LABORATORY DATA OF PROFILE DESCRIPTION No: 40

FIELD OBSERVATION No: 155-51 MAPPING UNIT: Ps 2.17 SOIL CLASSIFICATION: orthic SOLONETZ

Laboratory no. ...../ 79	4993	4994	4995	4996	4997	
Horizon	A	Bt1	Bt2	Bt3	Bt4	
Depth (cm)	0-15	15-30	30-45	45-106	106-160	
pH-H_2O(1:2½ v/v)	7.8	8.2	8.6	9.3	8.8	
pH-KCl ..	6.9	7.0	7.2	6.9	6.9	
EC (mmho/cm) ..	0.12	0.12	0.23	0.35	3.0	
$CaCO_3$ (%)	0	0.3	0.7	1.3	1.0	
$CaSO_4$ (%)	0.1	0.1	0.7	0.7	0.8	
C (%)	0.27	0.18	0.15	0.21	0.09	
N (%)						
C/N						
CEC (me/100g), pH 8.2	28.8	29.0	30.2	32.1	31.0	
CEC .. .. pH 7.0						
Exch.Ca (me/100g)	16.9	11.3	16.7	17.1	17.7	
.. Mg ..	2.3	17.7	16.2	18.7	17.7	
.. K ..	4.9	1.9	2.9	2.8	3.4	
.. Na ..	0.6	0.8	1.1	8.3	9.3	
Sum of cations	25	32	37	47	48	
Base sat. %, pH 8.2	86	100+	100+	100+	100+	
.. .. %, pH 7.0						
ESP at pH 8.2	2	3	4	26	30	
Saturation extract:						
Moisture %					81	
pH-paste					7.8	
ECe (mmho/cm)					12.0	
Na (me/l)						
K ..						
Ca ..						
Mg ..						
Sum of cations (me/l)						
CO_3 (me/l)						
HCO_3 ..						
Cl ..						
SO_4 ..						
Sum of anions (me/l)						
SAR						
Clay mineralogy:						
SiO_2/Al_2O_3 (mol/mol)						
SiO_2/R_2O_3 ..						
Fe_2O_3 (mmol%)						

X-ray report: A and Bt1 horizons: Predominantly amorphous, with traces of very poorly crystallized illite.

Depth (cm)	0-15	15-30	30-45	45-106	106-160	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	36	36	34	28	24	
Silt % 0.05–0.002mm	6	8	6	8	10	
Clay % 0.002–0 mm	58	56	60	64	66	
Texture class	C	C	C	C	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 20cm) Laboratory no. 4856 / 79

			Available	Total
pH-H_2O (1: 2½ v/v)	7.3		Available	Total
Exch. acidity (me/100g)	-	Na (me/100g)	0.22	
C%	0.52	K ..	1.20	
N%	-	Ca ..	9.2	
P-Olsen (ppm)		Mg ..	9.4	
		Mn ..	0.46	
		P (ppm)	22	

Various:

Remarks:

Profile description no. 41

Observation/date	: 155-55, Garissa District, Bura East Project/10-4-79
Soil classification	: chromic VERTISOL
Mapping unit	: Ps 3.1
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Chrysopogon aucheri, Andropogon canaliculatus, Aspilia mossambicensus, Duosperma eremophilum; dwarf shrub grassland
Salinity/sodicity	: Strongly saline and strongly sodic from 42cm onwards
Surface cracking	: 2-5cm wide cracks to a depth of 40cm
Drainage class	: Imperfectly drained

A 0-8cm Dark greyish brown (10YR 4/2 dry/moist); clay; weak, very fine and fine, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; moderately calcareous; many, fine pores; common, very fine and fine roots; abrupt and wavy transition to:

(sample no. 155-55a)

Bw1 8-42cm Dark greyish brown (10YR 4/1 dry, 10YR 4/2 moist) with patches of very dark greyish brown (10YR 3/2); clay; moderate, very coarse, prismatic structure; extremely hard when dry, firm when moist, sticky and plastic when wet; few, weak slickensides; slightly calcareous; common very fine and fine, very few medium pores; common, very fine and fine roots; abrupt and wavy transition to:

(sample no. 155-55b)

Bw2 42-68cm Very dark greyish brown (10YR 3/3 dry, 10YR 3/2 moist); clay; weak, very coarse, prismatic structure; very hard when dry, firm when moist, sticky and plastic when wet; common, weak slickensides; slightly calcareous; few, very fine and fine pores; common, very fine and fine roots; clear and wavy transition to:

(sample no. 155-55c)

Bky 68-117cm Dark greyish brown (10YR 4/2 dry/moist); clay; weak, coarse to very coarse prismatic structure breaking to weak, fine to medium, angular blocky; very hard when dry, firm when moist, sticky and plastic when wet; few, weak slickensides; strongly calcareous; some soft powdery lime and many gypsum crystals; few, very fine and fine pores; few, very fine roots; clear and smooth transition to:

(sample no. 155-55d)

Cz 117-180cm Dark grey (10YR 3/1 dry, 10YR 4/1 moist); clay; strong, medium to coarse, angular blocky structure; very hard when dry, firm when moist, very sticky and plastic when wet; abundant, strong slickensides; slightly calcareous; many salt crystals; few, very fine to fine pores.

(sample no. 155-55e)

LABORATORY DATA OF PROFILE DESCRIPTION No: 41

DOBSERVATION No: 155-55 **MAPPING UNIT:** Ps 3.1 **SOIL CLASSIFICATION:** chromic VERTISOL

boratory no. ...../ 79	5848	5849	5850	5851	5852	
rizon	A	Bw1	Bw2	Bky	Cz	
pth (cm)	0-8	8-42	42-68	68-117	117-180	
-H_2O(1: 2½ v/v)	8.6	8.9	8.2	8.2	8.3	
-KCl ..	7.3	7.5	7.3	7.5	7.6	
(mmho/cm) ..	0.40	0.75	4.5	8.0	7.5	
CO_3 (%)						
SO_4 (%)	tr	tr	tr	tr	tr	
(%)	0.47					
(%)						
N						
C (me/100g), pH 8.2	41.3	41.3	43.4	36.6	43.0	
C .. .. pH 7.0						
ch.Ca (me/100g)	49.8	37.3	35.0	46.8	30.0	
Mg ..	3.0	3.7	2.5	2.1	2.6	
K ..	1.9	1.9	2.7	2.8	2.6	
Na ..	0.8	4.3	9.2	13.1	18.6	
m of cations	56	47	49	65	54	
se sat. %, pH 8.2	100+	100+	100+	100+	100+	
.. %, pH 7.0						
P at pH 8.2	2	10	21	36	43	
aturation extract:						
isture %			81	80	141	
-paste			7.6	7.3	7.3	
e (mmho/cm)			15.5	21.0	21.5	
(me/l)			141	185	207	
..			0.98	1.09	0.98	
..			29.9	31.4	24.8	
..			15.7	22.6	26.2	
m of cations(me/l)			188	240	259	
3 (me/l)			0.36	0.21	0.16	
O_3 ..			1.90	1.32	1.54	
..			137	169	219	
..			10.1	10.5	7.5	
of anions(me/l)			147	180	227	
SAR			30	36	41	
lay mineralogy:						
$_2/Al_2O_3$(mol/mol)						
$_2/R_2O_3$ ..						
O_3(mmol%)						

ay report: A and Bw1 horizons: Predominantly poorly crystallized montmorillonite, grading into traces of illite.

Depth (cm)	0-8	8-42	42-68	68-117	117-180	
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	34	26	24	26	20	
Silt % 0.05–0.002mm	4	4	2	4	2	
Clay % 0.002–0 mm	62	70	74	70	78	
Texture class	C	C	C	C	C	
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
.. .. 1.0 – 0.50mm						
.. .. 0.50 – 0.25mm						
.. .. 0.25 – 0.10mm						
.. .. 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– 8 cm)		Laboratory no. 5848 / 79	Available	Total
pH-H_2O (1: 2½ v/v)	8.2		Available	Total
Exch. acidity (me/100g)	–	Na (me/100g)	1.78	
C%	0.47	K ..	0.53	
N%	–	Ca ..	25.0	
P-Olsen (ppm)		Mg ..	8.3	
		Mn ..	0.46	
		P (ppm)	10	

Various:

Remarks:

Kenya Soil Survey
Drawing No. 78050

Profile description no. 42

Observation/date	: 155-69, Garissa district, Bura East project, 11/7/79
Soil classification	: chromic VERTISOL
Mapping unit	: Ps 3.1
Parent material	: Marine/lacustrine sediments
Physiography	: Sedimentary plain
Slope	: Less than 0.5%
Vegetation	: Andropogon canaliculatus, Chrysopogon aucheri, Indigofera schimperi, Duosperma eremophilum, Aspilia mossambicensis; dwarf shrub grassland.
Salinity/sodicity	: Strongly sodic from 15cm and strongly saline from 102cm
Surface cracking	: 1-2cm wide cracks to a depth of 50cm
Drainage class	: Poorly drained

A 0-15cm Dark grey (10YR 4/1 moist); clay; moderate, very fine to medium, subangular blocky structure and moderate, fine to medium, crumb; slightly hard when dry; friable to firm when moist, sticky and plastic when wet; moderately calcareous; common, very fine to fine pores; pH-H_2O = 7.7; clear and smooth transition to:

(sample no. 155-69a)

Bw1 15-42cm Dark greyish brown (10YR 4/2 moist); clay; strong, medium to coarse, prismatic structure; firm when moist, sticky and plastic when wet; common, weak slickensides; moderately calcareous; few very fine and fine pores; pH-H_2O = 7.2; gradual and smooth transition to:

(sample no. 155-69b)

Bw2 42-102cm Dark greyish brown (10YR 4/2 moist); clay; weak, coarse, prismatic structure with tendency to moderate, fine to medium, angular blocky; firm when moist, sticky and plastic when wet; few, weak slickensides; moderately calcareous; few, very fine and fine pores; pH-H_2O = 7.9; gradual and smooth transition to:

(sample no. 155-69c)

Bw3 102-163cm Dark greyish brown (10YR 4/2 moist); clay; weak, very fine to medium angular blocky structure; firm when moist, sticky and plastic when wet; few, weak slickensides; moderately calcareous; pH-H_2O=7.7

(sample no. 155-65d)

BC	163-212cm	Grey (10YR 5/1 moist); clay; firm when moist, sticky and plastic when wet; slightly calcareous; pH-H_2O = 7.7 (sample no. 155-65e)
C	212-233cm	Light grey to grey (10YR 6/1 moist); clay; firm when moist, sticky and plastic when wet; slightly calcareous; pH-H_2O = 7.5 (sample no. 155-65f)

Note: Profile was augered from 143cm onwards.

LABORATORY DATA OF PROFILE DESCRIPTION No: 42

OBSERVATION No: 155-69 MAPPING UNIT: Ps 3.1 SOIL CLASSIFICATION: chromic VERTISOL

oratory no. ...../79	10258	10259	10260	10261	10262	10263
izon	A	Bw1	Bw2	Bw3	BC	C
th (cm)	0-15	15-42	41-102	102-163	163-212	212-233
-H_2O (1: 2½ v/v)	8.1	7.8	8.2	8.1	8.1	8.1
-KCl "	7.2	7.1	7.4	7.6	7.4	7.4
mmho/cm) ..	0.55	1.1	3.5	8.5	7.5	6.0
O_3 (%)						
O_4 (%)	tr	tr	tr	0.2	0.1	0.1
)	0.59	0.39	0.24	0.06	0.12	0.12
)						
(me/100g), pH 8.2	44.4	48.0	52.8	53.2	54.1	52.8
" " pH 7.0						
.Ca (me/100g)	36.5	31.5	31.9	34.0	53.5	51.0
Mg "	4.8	4.4	4.4	6.8	10.8	10.8
K "	1.2	1.2	1.3	0.6	0.5	0.1
Na "	3.6	11.2	15.3	22.9	24.9	27.6
of cations	46	48	52	64	89	90
sat. %, pH 8.2	100+	100+	100+	100+	100+	100+
" %, pH 7.0						
at pH 8.2	8	23	29	44	48	54
uration extract:						
ture %	68	55	-	105	120	-
paste	7.6	7.4	-	7.4	7.7	-
(mmho/cm)	1.6	2.2	-	21.5	18.5	-
e/l)	1.5	2.0	-	147	-	-
"	0.34	0.24	-	0.54	-	-
"	10.0	17.4	-	28.6	-	-
"	5.3	5.7	-	39.0	-	-
of cations (me/l)	17.1	25.3	-	215	-	-
me/l)	-	-	-	-	-	-
"	7.0	8.0	-	9.0	10.0	-
"	6.0	10.0	-	189	-	-
"	2.0	4.0	-	17.0	11.0	-
anions (me/l)	15.0	22.0	-	215	-	-
AR	1	1	-	25	-	-
mineralogy:						
l_2O_3 (mol/mol)						
R_2O_3 "						
(mmol%)						
report:						

Depth (cm)	0-15	15-42	42-102	102-163	163-212	212-233
Gravel %						
Texture, limited pretreatment:						
Sand % 2.0 – 0.05 mm	32	36	28	24	18	32
Silt % 0.05–0.002mm	6	2	4	2	2	2
Clay % 0.002–0 mm	62	62	68	74	80	76
Texture class	C	C	C	C	C	C
Dispersed clay %						
Flocculation index						
Texture USDA:						
Sand % 2.0 – 1.0mm						
" " 1.0 – 0.50mm						
" " 0.50 – 0.25mm						
" " 0.25 – 0.10mm						
" " 0.10 – 0.05mm						
Total sand %						
Silt %						
Clay %						
Texture class						
Bulk density						
Moisture % w/v at:						
pF 0						
pF 2.0						
pF 2.3						
pF 2.7						
pF 3.0						
pF 3.7						
pF 4.2						

Fertility aspects: (0– cm)		Laboratory no. /	Available	Total
pH–H_2O (1: v/v)			Available	Total
Exch. acidity (me/100g)		Na (me/100g)		
C%		K "		
N%		Ca "		
P–Olsen (ppm)		Mg "		
		Mn "		
		P (ppm)		

Various:

Remarks:

Kenya Soil Survey
Drawing No. 79050