SOILS AND IRRIGATION OF THREE AREAS IN THE LOWER TANA REGION KENYA

A comparative study of soil conditions and irrigation suitability

ANNEX TO
APPENDIX 2: DESCRIPTION OF SOIL MAPPING UNITS

F.N. MUCHENA

PROFILE DESCRIPTION No.: 1

Observation: 155-53; Garissa District, Bura East; 16-3-79.

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

Bt 17-32 cm — Dark brown to brown (10 YR 4/3 dry and 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; clear and wavy transition to:

Btz 32-78 cm — Greyish brown (10 YR 5/1 dry; 10 YR 5/2 moist); sandy clay; weak, medium angular blocky structure; very 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; gradual and smooth transition to:

Btzk 78-105 cm — Greyish brown (10 YR 5/2 dry and 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; gradual and smooth transition to:

BCzk 105-160 cm — Greyish brown (10 YR 5/2 dry and 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.

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

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 1.

Mapping unit: Ps 1.1. Soil classification: Calcari-gleyic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5 w/v)	pH-KCl (1:2.5 w/v)	EC (1:2.5 w/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 17	7.6	6.2	0.65	tr	tr	0,24	--	--	16.8	17.9	1.3	1.0	3.3	24	100+	18
Bt	17- 32	9.5	7.7	0.55	1.3	tr	0.41	--	--	14.8	16.7	2.1	0.2	2.2	21	100+	15
Btz	32- 78	8.6	7.7	6.5	2.3	tr	0.24	--	--	17.6	69.5	2.1	0.5	5.8	77	100+	33
Btzk	78-105	8.5	7.9	6.5	--	tr	0.12	--	--	21.3	46.5	1.8	0.7	14.6	64	100+	68
BCzk	105-160	8.4	7.7	6.0	--	1.2	0.09	--	--	23.4	51.7	1.9	0.5	15.6	70	100+	66

Depth in cm	Texture-Limited Pretreatment Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Saturation Extract Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	anions in me/litre CO3--	HCO3-	Cl-	SO4--	Sum	SAR
0- 17	68	8	24	Scl	--	--	--	--	--	--	--	--	--	--	--	--	--	--
17- 32	64	6	30	Scl	--	--	--	--	--	--	--	--	--	--	--	--	--	--
32- 78	52	8	40	Sc	53	7.5	24.0	--	--	--	--	--	--	--	--	--	--	--
78-105	52	8	40	Sc	44	7.6	21.0	159	0.26	34.0	18.2	211	0	26.0	70.0	14.1	110	31
105-160	50	8	42	Sc	52	7.4	23.5	176	0.26	33.0	25.4	235	0	27.0	196	11.3	234	33

Fertility aspects (0-20 cm)

pH-H2O (1:2.5 w/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.0	0.38	nd	nd	4.30	0.36	10.0	7.3	0.76	18

X-ray report on clay mineralogy

A- and Bt horizons predominantly well crystallized montmorillonite.

PROFILE DESCRIPTION No.: 2

Observation: 155-73 Garissa District; Bura East; 10-8-79.

A 0-9 cm	Dark brown (10 YR 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; gradual and smooth transition to:
Bt1 9-30 cm	Dark brown (10 YR 4/3 dry; 10 YR 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; clear and smooth transition to:
Bt2 30-66 cm	Dark greyish brown (10 YR 4/2 moist); clay; weak, coarse to very coarse prismatic breaking into 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; clear and smooth transition to:
BC 66-117 cm	Dark grey (10 YR 5/2 dry; 10 YR 4/1 moist); clay; massive with tendancy 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; diffuse and smooth transition to:
C 177-210 cm	Grey to light grey (10 YR 6/1 dry; 10 YR 5/1 moist); clay; massive; soft when dry, friable when moist, sticky and plastic when wet; common, very fine and fine pores.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 2.

Mapping unit: Ps 2.1. Soil classification: gleyic LUVISOL

Horizon	Depth in cm	pH-H2O (1:2.5%/v)	pH-KCl (1:2.5%/v)	EC (1:2.5%/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 9	6.7	5.4	0.08	--	tr	0.24	--	--	30.4	6.4	8.2	2.8	1.2	19	61	4
Bt1	9- 30	7.2	4.9	0.06	--	tr	0.33	--	--	33.2	6.4	10.4	3.4	2.1	22	67	6
Bt2	30- 66	7.3	5.9	0.19	--	tr	0.24	--	--	33.2	8.5	13.0	4.1	2.6	29	88	8
BC	66-117	7.9	6.6	0.35	--	tr	0.18	--	--	36.4	14.4	14.0	4.5	3.4	38	100+	9
C	117-150	8.6	6.9	0.35	--	tr	0.18	--	--	44.8	14.4	12.6	3.6	5.8	36	83	13
C	150-200	8.5	6.7	0.4	--	tr	0.36	--	--	42.8	16.3	12.4	3.9	14.8	47	100+	35

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 9	44	6	50	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
9- 30	34	6	60	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
30- 66	28	4	68	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
66-117	26	4	60	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
117-150	28	16	56	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
150-200	32	22	46	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-20 cm)

pH-H2O (1:2.5%/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Nehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
6.3	0.55	nd	nd	0.35	1.77	8.2	8.2	0.32	4

X-ray report on clay mineralogy

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.

PROFILE DESCRIPTION No. 3.

Observation: 141-8; Garissa District, Bura East; 13-9-79.

A 0-8 cm	Dark greyish brown (10 YR 5/2 dry; 10 YR 4/2 moist); sandy clay; porous massive with tendancy 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 and fine roots; clear and smooth transition to:
Bk 8-39 cm	Brown (10 YR 5/3 moist); sandy clay; porous massive with tendancy to weak, fine subangular blocky structure; friable when moist, sticky and plastic when wet; moderately calcareous; pockets of soft lime (10-15%); many, very fine and fine and common, medium pores; many, very fine and fine roots; gradual and smooth transition to:
Bt1k 39-85 cm	Dark greyish brown (10 YR 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; diffuse and smooth transition to:
Bt2 85-133 cm	Grey to light grey (10 YR 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; diffuse and smooth transition to:
Bt3 133-250 cm	Greyish brown (10 YR 5/2 moist); clay; porous massive with tendancy 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;
C1 250-285 cm	Brown (10 YR 5/3 moist); clay; sticky and plastic when wet; slightly calcareous;
C2 285-355 cm	Greyish brown (10 YR 5/2 moist); clay; sticky and plastic when wet; slightly calcareous.

Note: The profile was augered from 180 cm.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 3.

Mapping unit: Ps 2.2. Soil classifcation: Calcari-gleyic LUVISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 8	8.1	--	0.55	1.1	0.2	0.59	--	--	25.0	26.7	0.6	2.4	0.2	30	100+	1
Bk	8- 39	8.3	--	0.45	1.9	0.1	--	--	--	23.8	43.5	1.5	1.8	0.3	47	100+	1
Btlk	39- 85	8.2	--	0.40	1.6	tr	--	--	--	30.5	39.7	3.4	1.8	0.6	46	100+	2
Bt2	85-133	8.4	--	0.40	1.6	tr	--	--	--	--	--	--	--	--	--	--	--
Bt3	133-150	8.6	--	0.45	1.4	tr	--	--	--	31.8	40.0	3.6	2.1	2.0	48	100+	6
Bt3	150-200	8.9	--	0.45	2.1	tr	--	--	--	33.1	39.9	4.8	2.0	4.5	51	100+	14
Bt3	200-250	8.7	--	0.50	1.6	0.5	--	--	--	33.4	31.2	--	0.8	9.6	--	--	--
C1	250-285	9.0	--	0.60	2.6	1.0	--	--	--	34.6	14.7	--	0.9	17.6	--	--	--
C2	285-355	9.2	--	0.70	3.1	1.2	--	--	--	43.0	14.7	--	0.7	13.1	--	--	--
C2	355-404	9.3	--	1.35	2.4	1.4	--	--	--	49.8	6.0	--	0.5	24.4	--	--	--

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 8	56	4	40	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8- 39	48	8	44	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
39- 85	42	8	50	C	58	7.5	0.30	1.78	0.28	1.50	0.4	4.0	0	2.00	1.00	0.94	3.9	2
85-133	38	6	56	C	62	8.0	0.40	2.76	0.18	1.00	0.63	4.6	0	3.10	0.94	0.94	5.0	3
133-150	36	4	60	C	73	8.1	0.50	3.95	0.23	0.75	0.63	5.6	0	4.00	1.00	0.94	5.9	5
150-200	36	6	58	C	75	8.2	0.50	5.00	0.28	0.75	0.42	5.5	0	3.80	2.00	0.94	6.7	7
200-250	32	8	60	C	90	8.1	0.15	--	--	--	--	--	--	--	--	--	--	--
250-285	34	10	56	C	123	8.4	0.15	--	--	--	--	--	--	--	--	--	--	--
285-355	36	8	56	C	73	7.7	0.40	1.00	0.23	2.50	0.40	4.1	0	3.60	1.00	--	--	1
355-404	38	6	56	C	85	8.1	0.70	4.50	0.25	1.50	0.63	6.9	0	5.10	1.25	0.94	7.3	4

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	NI	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
7.5	0.59	nd	nd	0.38	1.12	9.2	5.9	0.50	10

X-ray report on clay mineralogy

A- and Bk horizons, mainly poorly crystallized illite-montmorillonite intergrade with traces of illite.

PROFILE DESCRIPTION No. 4.

Observation: 141-9; Garissa District, Bura East; 14-9-79.

A 0-38 cm	Dark greyish brown (10 YR 5/2 dry, 10 YR 4/2 moist); clay; porous massive with tendancy 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; clear and smooth transition to:
Bw1 38-64 cm	Dark greyish brown (10 YR 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; gradual and smooth transition to:
Bw2 64-96 cm	Dark grey (10 YR 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; gradual and smooth transition to:
Bw3 96-120 cm	Very dark greyish brown (10 YR 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); clear and smooth transition to:
Bw4 120-196 cm	Dark greyish brown (10 YR 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);
BC1 196-241 cm	Brown (10 YR 5/3 moist); clay; moderately calcareous;
BC2 241-269 cm	Greyish brown (10 YR 5/2 moist); clay; slightly calcareous;
Ck1 269-325 cm	Light brownish grey (10 YR 6/2 moist); gravelly clay; slightly calcareous; many calcium carbonate nodules;
Ck2 325-360 cm	Light brownish grey (10 YR 6/2 moist); clay; slightly calcareous; many calcium carbonate nodules.

Notes:
1. Sandy material from the topsoil has been washed down into the Bw1-horizon.
2. The profile was augered from 196 cm.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 4.

Mapping unit: Ps 2.3. Soil classification: Calcari-gleyic CAMBISOL

Horizon	Depth in cm	pH-H2O (1:2.5%)	pH-KCl (1:2.5%)	EC (1:2.5%) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 38	8.2	--	0.30	1.3	tr	0.42	--	--	33.0	54.7	4.1	2.9	0.4	62	100+	1
BW1	38- 64	8.3	--	0.30	1.2	tr	--	--	--	31.5	41.7	5.6	3.2	0.8	51	100+	3
BW2	64- 96	8.9	--	0.40	1.2	tr	--	--	--	33.7	40.0	6.2	2.4	2.4	51	100+	9
BW3	96-120	9.3	--	0.75	1.2	tr	--	--	--	31.5	39.5	5.6	2.4	10.8	60	100+	34
BW4	120-196	9.6	--	1.6	1.3	0.4	--	--	--	35.9	12.6	--	1.6	20.0	--	--	56
BC1	196-241	9.6	--	2.1	1.3	0.1	--	--	--	33.4	6.7	--	0.7	17.5	--	--	52
BC2	241-269	9.5	--	2.3	0.9	0.2	--	--	--	48.2	4.9	--	0.5	18.0	--	--	37
Ck1	269-325	9.5	--	2.4	0.7	1.2	--	--	--	43.0	12.5	--	0.8	10.8	--	--	25
Ck2	325-360	--	--	--	1.8	0.1	--	--	--	49.8	7.7	--	0.9	22.2	--	--	45

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 38	36	6	58	C	56	7.7	0.40	--	--	--	--	--	--	--	--	--	--	--
38- 64	42	4	54	C	56	8.0	0.40	--	--	--	--	--	--	--	--	--	--	--
64- 96	38	4	58	C	64	8.4	0.50	--	--	--	--	--	--	--	--	--	--	--
96-120	36	6	58	C	108	8.7	0.65	--	--	--	--	--	--	--	--	--	--	--
120-196	34	6	60	C	103	8.6	2.15	--	--	--	--	--	--	--	--	--	--	--
196-241	26	6	68	C	123	8.5	6.5	--	--	--	--	--	--	--	--	--	--	--
241-269	32	2	66	C	112	9.3	5.5	52.0	0.10	0.50	2.08	55	0	8.1	42.5	2.9	54	46
269-325	30	8	62	C	125	8.4	6.5	63.0	0.05	0.50	1.25	65	0	7.6	53.0	3.4	64	68
325-360	28	8	64	C	118	8.1	14.0	132	0.10	2.50	5.83	140	0	8.2	127	5.7	141	65

Fertility aspects (0-30 cm)

pH-H2O (1:2.5%)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.4	0.42	nd	nd	0.47	0.69	28.4	8.4	0.16	20

X-ray report on clay mineralogy

A-horizon - traces of illite with illite-montmorillonite intergrade.
BW1-horizon - illite with traces of montmorillonite.

PROFILE DESCRIPTION No. 5.

Observation: 155-65, Garissa District, Bura East; 11-7-79.

A 0-10 cm	Dark reddish brown (7.5 YR 4/4 dry; 5 YR 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; clear and smooth transition to:
AB 10-47 cm	Dark reddish brown (5 YR 4/6 dry; 5 YR 3/3 moist); clay; 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; gradual and smooth transition to:
Bw 47-104 cm	Dark reddish brown (5 YR 3/4 dry; 5 YR 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 clay-skins/pressure faces; moderately calcareous; common, very fine pores; common, very fine and few, fine roots; gradual and smooth transition to:
BC 104-152 cm	Reddish brown (5 YR 5/6 dry; 5 YR 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;
C1 152-208 cm	Dark brown to brown (10 YR 5/4 dry, 10 YR 4/3 moist); clay; sticky and plastic when wet; moderately calcareous;
C2 208-317 cm	Dark brown to brown (10 YR 4/3 moist); clay;
C3 317-380 cm	Brown (10 YR 5/3 moist); clay.

Note: The profile was augered from 152 cm.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 5.

Mapping unit: Ps 2.4. Soil classification: Chromi-calcaric CAMBISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 10	8.1	7.1	0.30	--	0.1	0.53	--	--	40.0	26.0	11.1	1.1	2.1	40	--	5
AB	10- 47	8.5	7.2	0.16	--	0.1	0.41	--	--	34.8	24.4	12.6	0.9	2.9	41	--	8
BW	47-104	8.7	7.3	0.35	--	0.5	0.12	--	--	38.0	32.0	12.4	0.9	6.9	52	--	18
BC	104-152	9.0	7.6	2.3	--	0.1	0.06	--	--	41.2	34.0	15.6	1.0	11.0	62	--	27
C1	152-208	8.8	7.8	4.4	--	1.2	0.09	--	--	41.2	32.0	8.0	0.8	14.2	55	--	34
C2	208-235	--	--	--	1.4	--	--	--	--	33.4	3.0	--	0.3	15.2	--	--	46
C2	235-275	--	--	--	2.2	--	--	--	--	32.2	8.7	--	1.5	18.0	--	--	47
C2	275-296	--	--	--	1.0	--	--	--	--	33.4	8.7	--	0.6	14.0	--	--	42
C2	296-317	--	--	--	1.4	--	--	--	--	--	--	--	--	--	--	--	--
C3	317-380	--	--	--	0.8	--	--	--	--	37.4	3.0	--	0.4	11.6	--	--	31

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 10	44	6	50	C	47	8.5	0.75	3.00	0.80	2.5	1.4	7.7	2.0	4.0	2.90	0.31	9.2	2
10- 47	40	4	56	C	49	8.6	0.45	1.80	0.26	--	--	--	2.25	1.0	1.00	0.31	4.6	--
47-104	40	4	56	C	56	8.1	0.24	1.82	0.13	--	--	--	0	0.90	1.10	0.31	2.3	--
104-152	38	2	60	C	64	7.7	11.0	92.0	0.32	5.2	11.1	109	0	8.0	98.2	2.2	108	32
152-208	32	6	62	C	89	8.3	17.5	145	0.45	12.8	17.7	176	0	9.0	161	4.7	175	37
208-235	26	10	64	C	71	7.6	20.5	172	0.31	9.00	23.3	206	0	7.0	187	5.30	199	43
235-275	26	10	64	C	89	7.9	4.0	20.0	0.32	9.50	8.73	38.6	0	8.0	31.5	0.40	39.9	79
275-296	32	8	60	C	79	8.0	8.0	60.0	0.31	9.50	8.75	78.6	0	8.0	69.0	1.30	78.3	20
296-317	28	10	62	C	105	7.6	4.5	34.0	0.13	4.00	7.08	45.2	0	7.7	36.0	1.1	44.8	14
317-380	26	8	66	C	101	8.0	5.0	38.0	0.19	5.00	6.25	49.4	0	6.9	41.0	1.1	49.0	16

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
7.8	0.62	--	--	0.30	1.50	13.4	6.1	0.61	11

X-ray report on clay mineralogy

A-horizon - traces of poorly crystallized illite.
AB-horizon- traces of illite and montmorillonite.

PROFILE DESCRIPTION No. 6.

Observation: 141-5; Garissa District; Bura East; 13-3-79.

A 0-10 cm	Brown (10 YR 5/3 dry; 10 YR 5/3 moist); sandy clay/clay; weak, fine subangular blocky with tendancy to weak, very fine crumb structure; soft when dry, friable when moist, sticky and plastic when wet; many macro and few biopores; many, very fine and fine roots; clear and smooth transition to:
AB 10-22 cm	Dark greyish brown (10 YR 5/3 dry; 10 YR 4/2 moist); sandy clay/clay; porous massive with tendancy to weak, very fine and fine, crumb 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; clear and wavy transition to:
Bu1 22-43 cm	Dark greyish brown (10 YR 5/3 dry; 10 YR 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; gradual and smooth transition to:
Bu2K 43-90 cm	Dark grey (10 YR 4/2 dry; 10 YR 4/1 moist); clay; moderate, coarse to very coarse, prismatic with tendancy 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/pressure faces; strongly calcareous; some pockets of soft powdery lime; few macro and biopores; common, very fine and fine roots; gradual and smooth transition to:
Bu3K 90-125 cm	Dark greyish brown (10 YR 5/3 dry; 10 YR 4/2 moist); clay; porous massive; sticky and plastic when wet; thick slickensides; strongly calcareous; some pockets of soft powdery lime; few macro pores; few, very fine and fine roots.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 6.

Mapping unit: Ps 2.5. Soil classification: Luvi-haplic CALCISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 10	8.4	7.1	0.30	0.2	0.1	0.56	--	--	30.7	30.0	1.8	4.3	0.9	37	100+	3
AB	10- 22	8.8	7.0	0.20	1.2	0.2	--	--	--	31.6	69.5	3.2	3.6	1.4	78	100+	4
Bul	22- 43	9.0	7.2	0.40	4.4	0.1	--	--	--	30.2	57.0	4.1	1.2	6.8	69	100+	23
Bu2K	43- 90	8.7	7.4	2.20	5.4	tr	--	--	--	33.1	41.5	4.1	2.2	14.6	62	100+	44
Bu3K	90-125	8.9	7.6	3.50	6.4	tr	--	--	--	35.6	54.0	4.4	2.5	13.1	74	100+	37

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 10	44	8	48	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10- 22	40	8	52	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
22- 43	38	8	54	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
43- 90	38	8	54	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
90-125	32	8	60	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.1	0.56	--	--	0.79	0.70	19.6	5.7	0.40	44

X-ray report on clay mineralogy

A-, AB- and Bul horizons - mainly illite-montmorillonite intergrade with traces of poorly crystallized illite.

PROFILE DESCRIPTION No. 7.

Observation; 155-79, Garissa District, Bura East; 8-9-79.

A 0-14 cm	Dark brown (10 YR 4/3 dry; 10 YR 3/3 moist); sandy clay; moderate, very fine to medium crumb structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many, very fine and fine pores; many, very fine and fine, few, medium roots; clear and wavy transition to:
Bw1 14-30 cm	Dark brown to brown (10 YR 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; strongly calcareous; common, very fine and fine pores; common, very fine and fine, few, medium roots; gradual and smooth transition to:
Bw2k 30-62 cm	Dark brown to brown (10 YR 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/pressure faces; strongly calcareous; few pockets of soft powdery lime (1%); few, very fine and fine pores; few, very fine and fine roots; clear and smooth transition to:
Bw3ky 62-100 cm	Brown (10 YR 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; strongly calcareous; many pockets of soft powdery lime and many gypsum crystals; common, very fine and fine pores; very few, very fine roots; diffuse and smooth transition to:
BCy 100-172 cm	Greyish brown (10 YR 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;
Cy 172-228 cm (augered)	Grey (10 YR 5/1 moist); clay; sticky and plastic when wet; non-calcareous; many gypsum crystals.

Note: Cracks extend into the Bw2k-horizon and are partly filled up with sandy material from the topsoil.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 7.

Mapping unit: Ps 2.6. Soil classification: Verti-haplic CALCISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 14	8.3	nd	0.30	2.0	tr	0.71	--	--	39.0	56.6	1.5	1.6	0.7	60	100+	2
BW1	14- 30	8.5	nd	0.30	3.2	tr	--	--	--	35.8	61.2	2.8	1.1	2.1	67	100+	9
BW2k	30- 62	8.4	nd	0.50	4.2	tr	--	--	--	31.5	61.2	3.4	0.9	4.6	70	100+	15
BW3ky	62-100	7.8	nd	3.00	3.1	0.4	--	--	--	33.4	18.2	--	0.6	21.4	--	--	64
BCy	100-120	8.1	nd	7.50	2.0	0.5	--	--	--	43.0	22.2	--	0.4	16.3	--	--	38
BCy	120-172	7.8	nd	8.00	2.3	0.3	--	--	--	39.8	8.6	--	0.2	13.9	--	--	35
Cy	172-200	7.7	nd	10.00	tr	1.2	--	--	--	41.4	20.2	--	0.4	20.6	--	--	50

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 14	50	6	44	SC	57	7.5	0.50	1.00	0.20	1.50	2.38	5.1	0	1.25	3.35	0.94	5.5	1
14- 30	42	8	50	C	60	7.9	0.60	2.00	0.20	2.00	2.38	6.6	0	2.50	3.00	0.94	6.4	1
30- 62	40	10	50	C	82	8.1	0.45	1.50	0.25	2.00	0.63	4.4	0	2.00	1.50	0.94	4.4	1
62-100	38	2	60	C	75	7.1	8.5	33.0	0.17	28.00	23.8	85.0	0	7.20	69.0	9.40	85.6	6
100-120	36	8	56	C	110	7.6	15.5	122	0.14	15.50	18.3	156	0	6.00	138	11.8	156	30
120-172	36	6	58	C	114	7.5	18.0	150	0.19	13.00	18.3	181	0	7.85	165	7.50	180	38
172-200	28	8	64	C	141	7.6	16.0	141	0.25	8.50	12.5	162	0	7.85	148	4.70	161	44

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.1	0.71	--	--	0.84	0.37	30.4	6.0	0.02	6

X-ray report on clay mineralogy

PROFILE DESCRIPTION No. 8.

Observation: 155-59; Garissa District, Bura East, 7-7-79.

A 0-11 cm	Dark brown (7.5 YR 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; gradual and smooth transition to:
Bt1 11-28 cm	Brown to dark brown (7.5 YR 5/2 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; gradual and smooth transition to:
Bt2k 28-75 cm	Brown (7.5 YR 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; clear and smooth transition to:
Bt3ky 75-192 cm	Pinkish grey (7.5 YR 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;
C1 192-227 cm	Light brownish grey (10 YR 6/2 moist); clay; sticky and plastic when wet;
C2 227-297 cm	Grey to light grey (10 YR 6/1 moist); clay; sticky and plastic when wet;
C3 297-346 cm	Greyish brown (10 YR 5/2 moist); clay; sticky and plastic when wet;
C4 346-374 cm	Greyish brown (10 YR 5/2 moist); gravelly clay; sticky and plastic when wet.

Note: Profile was augered from 160 cm onwards.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 8.

Mapping unit: Ps 2.7. Soil classification: Calcari-gleyic LUVISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 11	7.8	6.2	0.18	--	tr	0.38	--	--	28.8	12.4	6.8	1.1	1.2	22	75	4
Bt1	11- 28	8.8	7.1	0.40	--	tr	--	--	--	38.0	26.0	10.8	1.7	3.6	42	100+	10
Bt2k	28- 75	9.4	7.7	0.55	--	tr	--	--	--	40.0	28.0	6.2	0.7	11.9	47	100+	30
Bt3ky	75-150	8.6	7.8	5.5	--	tr	--	--	--	51.4	23.0	5.4	0.7	24.3	53	100+	47
Bt3ky	150-192	--	--	--	4.2	--	--	--	--	32.2	36.7	--	0.6	21.1	--	--	66
C1	192-227	--	--	--	3.8	--	--	--	--	33.4	18.1	--	0.3	15.8	--	--	47
C2	227-297	--	--	--	--	--	--	--	--	37.4	14.7	--	0.3	15.8	--	--	42
C3	297-346	--	--	--	--	--	--	--	--	38.2	12.5	--	0.3	24.4	--	--	64
C4	346-374	--	--	--	--	--	--	--	--	38.2	17.2	--	0.3	23.7	--	--	62

	Texture-Limited Pretreatment				Saturation Extract			cations in me/litre				anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 11	60	6	34	SCL	36	6.5	0.50	1.90	0.48	1.70	1.10	5.2	0	4.0	1.0	0.31	5.3	2
11- 28	50	4	46	SC	66	8.2	0.90	4.00	0.13	--	--	--	0	3.0	4.9	0.31	8.2	--
28- 75	52	6	42	SC	86	8.9	4.3	21.00	0.26	--	--	--	0	5.0	37.0	0.31	42.3	--
75-150	38	2	60	C	73	8.0	15.5	105	0.38	22.80	27.00	155	0	8.0	129	17.4	154	21
150-192	38	2	60	C	81	7.6	20.0	149	0.25	25.50	25.00	199	0	7.2	186	6.8	200	30
192-227	36	4	60	C	80	7.5	23.0	172	0.15	30.0	28.30	230	0	6.9	214	8.2	229	--
227-297	34	8	58	C	86	7.6	21.0	175	0.10	16.50	18.80	210	0	5.2	198	5.7	209	42
297-346	38	10	52	C	102	7.6	18.0	161	0.03	9.00	11.70	181	0	4.8	173	3.4	181	50
346-374	40	12	48	C	91	7.8	17.0	150	0.05	9.00	10.80	170	0	8.0	160	3.8	172	48

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na	K	Ca	Mg	Mn	P
7.9	0.38	--	--	1.22	0.76	9.8	7.1	0.65	8

X-ray report on clay mineralogy

A-, Bt1- and Bt2k horizons: moderately crystallized illite and montmorillonite.

PROFILE DESCRIPTION No. 9.

Observation: 155-100; Garissa District, Bura East; 14-12-79.

Au1 0-5 cm	Brown to dark brown (10 YR 4/3 moist); clay; porous massive; slightly hard when dry, friable when moist, sticky and plastic when wet; non-calcareous; common, very fine and fine, very few, medium roots; moderate biological activity; abrupt and wavy transition to:
Au2 5-17 cm	Dark brown (10 YR 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; clear and smooth transition to:
Bu1 17-63 cm	Very dark greyish brown (10 YR 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); clear and smooth transition to:
Bu2k 63-89 cm	Dark brown (10 YR 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/pressure faces; strongly calcareous; few pockets of soft powdery lime; few, fine and medium pores; few, very fine and fine roots (some dead); diffuse and smooth transition to:
Bu3y 89-125 cm	Brown to dark brown (10 YR 4/3 moist); clay; moderate,fine to medium angular blocky structure; friable when moist, sticky and plastic when wet; few slickensides; strongly calcareous; many gypsum crystals (10%); common, fine pores; very few, fine roots (some dead); diffuse and smooth transition to:
Bu4y 125-212 cm	Brown (10 YR 5/3 moist); clay; weak, fine to medium angular blocky structure; friable when moist, sticky and plastic when wet; common slickensides; strongly calcareous; many gypsum crystals (5%); common, very fine roots (some dead);
C1 212-340 cm	Grey (10 YR 5/1 moist); clay; sticky and plastic when wet; strongly calcareous;
C2 340-363 cm	Greyish brown (10 YR 5/2 moist); clay; sticky and plastic when wet; strongly calcareous.

Note: Profile was augered from 160 cm.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 9.

Mapping unit: Ps 2.8. Soil classification: Verti-haplic CALCISOL

Horizon	Depth in cm	pH-H2O (1:2.5%)	pH-KCl (1:2.5%)	EC (1:2.5%) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Au1	0- 5	8.4	--	0.35	--	0.1	0.62	--	--	40.5	37.6	6.6	3.2	1.5	49	100+	3
Au2	5- 17	8.4	--	0.35	--	0.3	--	--	--	35.4	59.1	9.2	2.9	2.2	74	100	6
Bu1	17- 63	9.1	--	1.40	--	0.1	--	--	--	53.5	42.0	12.8	1.4	15.5	72	100	29
Bu2k	63- 89	8.8	--	4.00	--	0.1	--	--	--	53.8	44.0	15.2	1.3	24.1	85	100	45
Bu3y	89-125	8.3	--	7.50	--	0.1	--	--	--	50.8	45.0	12.0	0.9	23.1	81	100	46
Bu4y	125-168	8.4	--	9.00	--	0.8	--	--	--	53.7	44.0	15.2	0.9	25.1	85	100	49
Bu4y	168-212	8.4	--	6.50	--	0.7	--	--	--	44.0	61.5	12.4	0.9	24.5	99	100	56
C1	212-276	8.5	--	7.00	--	tr	--	--	--	35.4	51.5	12.0	0.9	25.1	90	100	71
C1	276-340	8.6	--	7.00	--	tr	--	--	--	34.6	34.0	14.4	0.3	27.7	76	100+	80
C2	340-363	8.5	--	7.00	--	tr	--	--	--	33.6	32.0	14.0	0.3	28.3	85	100+	84

Texture-Limited Pretreatment				Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 5	44	8	48	C	34	8.0	1.30	--	--	--	--	--	0	3.60	--	--	--	--
5- 17	44	4	52	C	61	8.0	1.05	2.78	0.28	4.00	1.67	8.7	0	4.80	6.70	0.20	11.7	2
17- 63	40	8	52	C	87	7.6	2.80	24.0	0.23	2.50	1.25	28.0	0	7.20	11.5	9.50	28.2	18
63- 89	38	8	54	C	81	7.4	12.0	60.0	0.23	29.00	30.00	119	0	5.60	111	5.70	122	11
89-125	40	4	56	C	81	7.7	20.0	156	0.18	18.50	24.20	199	0	5.20	188	7.10	200	34
125-168	32	8	60	C	109	7.7	23.0	190	0.23	21.00	16.70	228	0	5.60	220	3.80	229	44
168-212	38	0	62	C	102	7.6	14.5	129	0.18	6.50	9.17	145	0	4.40	140	3.80	148	46
212-276	42	6	52	C	112	7.6	15.5	136	0.36	7.50	10.80	154	0	4.80	146	4.30	154	45
276-340	38	8	54	C	112	8.1	9.5	--	--	--	--	--	--	--	--	--	--	--
340-363	38	10	52	C	112	8.0	16.0	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-30 cm)

pH-H2O (1:2.5%)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.1	0.62	--	--	nd	1.08	33.5	8.4	0.39	22

X-ray report on clay mineralogy

Au1-, Au2 and Bu1 horizons: Traces of illite and montmorillonite grading into one another.

PROFILE DESCRIPTION No. 10.

Observation: 155-86; Garissa District, Bura East; 10-9-79.

A 0-10 cm	Dark brown to brown (10 YR 3/3 dry, 10 YR 4/3 moist); sandy clay loam; moderate, very fine and fine crumb 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; clear and wavy transition to:
Bt 10-40 cm	Dark brown to brown (10 YR 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; clear and smooth transition to:
Btk 40-60 cm	Dark brown (10 YR 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 mycelium; many, very fine and fine, few, medium pores; very few, very fine and fine (dead) roots; clear and smooth transition to:
BCz 60-95 cm	Very dark greyish brown (10 YR 3/2 moist); clay; moderate, fine and medium angular blocky structure; firm when moist, sticky and plastic when wet; many salt crystals; strongly calcareous; common, very fine pores; very few, very fine (dead) roots:
Cz1 95-174 cm	Dark greyish brown (10 YR 4/2 moist); clay; moderate, very fine and fine angular blocky structure; firm when moist, sticky and plastic when wet; strongly calcareous; many salt crystals; common, very fine pores; no roots observed;
Cz2 174-232 cm (augered)	Greyish brown (10 YR 5/2 moist); clay; sticky and plastic when wet, strongly calcareous; many salt crystals.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 10.

Mapping unit: Ps 2.9. Soil classification: Calcari-haplic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5%/,)	pH-KCl (1:2.5%/,)	EC (1:2.5%/,) mohos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 10	7.7	nd	0.40	0.9	0.1	0.77	--	--	18.4	21.2	2.0	1.5	0.6	25	--	3
Bt	10- 40	9.0	nd	0.65	3.9	0.1	--	--	--	37.0	36.8	16.8	0.6	5.8	60	--	14
Btk	40- 60	8.5	nd	4.5	4.0	0.1	--	--	--	32.6	14.0	--	0.4	8.3	--	--	25
BCz	60- 95	8.2	nd	6.5	3.8	0.1	--	--	--	30.2	14.7	--	0.6	10.1	--	--	33
Cz1	95-174	8.5	nd	4.0	2.3	0.2	--	--	--	27.0	16.2	--	0.5	9.1	--	--	33
Cz2	174-232	8.4	nd	6.0	4.5	0.1	--	--	--	nd	--	--	--	--	--	--	--

	Texture-Limited Pretreatment				Saturation Extract							anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mohos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 10	62	8	30	SCL	49	7.6	0.90	3.00	0.18	4.50	1.88	9.6	0	7.33	1.60	1.00	9.9	2
10- 40	50	8	42	SC	67	7.7	0.90	--	--	--	--	--	0	4.66	--	--	--	--
40- 60	44	8	48	C	72	7.6	13.5	90.0	0.13	23.5	24.0	138	0	9.99	117	8.30	135	18
60- 95	40	2	58	C	79	7.6	17.0	114	0.20	31.3	26.0	171	0	6.66	150	14.0	171	21
95-174	40	8	52	C	88	7.7	12.5	120	0.22	13.3	10.4	144	0	6.66	109	8.3	123	35
174-232	38	10	52	C	127	7.5	16.0	119	0.18	24.5	17.1	161	0	5.99	141	13.1	160	26

Fertility aspects (0-30 cm)

pH-H2O (1:2.5%/,)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
7.9	0.77	--	--	1.80	0.34	23.9	7.4	0.64	16

X-ray report on clay mineralogy

PROFILE DESCRIPTION No. 11.

Observation: 155-50; Garissa District, Bura East; 15-3-79.

A 0-12 cm	Brown to dark brown (7.5 YR 4.5/4 dry, 7.5 YR 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; abrupt and wavy transition to:
Bt1 12-55 cm	Dark red (2.5 YR 3/6 dry/moist); sandy clay; moderate, medium to coarse prismatic structure with tendancy to break into 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; clear and wavy transition to:
Bt2 55-80 cm	Reddish brown (5 YR 5/6 - 7.5 YR 5/6 dry, 5 YR 4/4 moist); sandy clay; weak, medium to coarse prismatic structure with tendancy to break into 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; clear and smooth transition to:
BC 80-106 cm	Brown (7.5 YR 6/6 - 10 YR 6/4 dry, 7.5 YR 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; diffuse and smooth transition to:
Cz 106-169 cm	Yellowish brown (10 YR 6/4 dry, 10 YR 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.

Note: A very thin, compact, bleached layer forms the upper part of the Bt1 horizon.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 11.

Mapping unit: Ps 2.17. Soil classification: Calcari-chromic LUVISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 12	7.2	6.2	0.07	0	0.1	0.24	--	--	7.5	4.6	1.7	1.3	0.5	8	100	6
Bt1	12- 50	7.7	7.2	0.40	0	0.1	0.15	--	--	21.3	8.4	11.0	3.1	2.4	25	100	11
Bt2	50- 80	8.4	7.3	1.3	0	0.2	0.21	--	--	27.0	21.4	1.8	3.8	4.0	31	100	15
BC	80-106	8.5	7.2	1.6	1.8	0.2	0.09	--	--	25.2	23.5	1.7	3.5	7.1	36	100	28
Cz	106-169	8.2	6.1	3.5	1.3	0.2	0.12	--	--	24.3	27.8	2.1	3.3	13.3	47	100	55

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 12	78	6	16	SL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
12- 50	54	4	42	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
50- 80	48	8	44	SC	45	7.5	6.5	46.0	1.03	8.0	9.90	63.2	0	20.8	42.0	1.17	63.2	15
80-106	50	10	40	SC	38	7.3	10.0	78.0	0.77	13.4	6.60	98.8	0	19.0	--	--	--	29
106-169	44	16	40	C	55	7.2	16.5	nd	nd	nd	nd	--	--	--	--	--	--	--

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
--	--	--	--	--	--	--	--	--	--

X-ray report on clay mineralogy

A- and Bt1 horizons: moderately crystallized illite is predominant, but grades into montmorillonite.

PROFILE DESCRIPTION No. 12

Observation: 155-55; Garissa District, Bura East; 10-4-79.

A 0-8 cm	Dark greyish brown (10 YR 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:
Bu1 8-42 cm	Dark greyish brown (10 YR 4/1 dry, 10 YR 4/2 moist) with patches of very dark greyish brown (10 YR 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:
Bu2 42-68 cm	Very dark greyish brown (10 YR 3/3 dry, 10 YR 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:
Bky 68-117 cm	Dark greyish brown (10 YR 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:
Cz 117-180 cm	Dark grey (10 YR 3/1 dry, 10 YR 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.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 12.

Mapping unit: Ps 3.1. Soil classification: Chromi-calcic VERTISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 8	8.6	7.3	0.40	--	tr	0.47	--	--	41.3	49.8	3.0	1.9	0.8	56	100+	2
Bw1	8- 42	8.9	7.5	0.75	--	tr	--	--	--	41.3	37.3	3.7	1.9	4.3	47	100+	10
Bw2	42- 68	8.2	7.3	4.5	--	tr	--	--	--	43.4	35.0	2.5	2.7	9.2	49	100+	21
Bky	68-117	8.2	7.5	8.0	--	tr	--	--	--	36.6	46.8	2.1	2.8	13.1	65	100+	36
Cz	117-180	8.3	7.6	7.5	--	tr	--	--	--	43.0	30.0	2.6	2.6	18.6	54	100+	43

Depth in cm	Texture-Limited Pretreatment Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Saturation Extract Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	anions in me/litre CO3--	HCO3-	Cl-	SO4--	Sum	SAR
0- 8	34	4	62	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
8- 42	26	4	70	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
42- 68	24	2	74	C	81	7.6	15.5	141	0.98	29.9	15.7	188	0.36	1.90	137	10.1	147	30
68-117	26	4	70	C	80	7.3	21.0	185	1.09	31.4	22.6	240	0.21	1.32	169	10.5	180	36
117-180	20	2	78	C	141	7.3	21.5	207	0.98	24.8	26.2	259	0.16	1.54	219	7.5	227	41

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.2	0.47	--	--	1.78	0.53	25.0	8.3	0.46	10

X-ray report on clay mineralogy

A- and Bw1 horizons: predominantly poorly crystallized montmorillonite with traces of illite.

PROFILE DESCRIPTION No. 13.

Observation:	N2-1; Tana River District, Bura West; 28-2-85.
A 0-22 cm	Reddish brown (5 YR 5/6 dry, 5 YR 4/4 moist); sandy clay loam/sandy clay; weak, very fine subangular blocky and weak, very fine crumb structure; loose when dry, friable when moist, slightly sticky and slightly plastic when wet; many, very fine pores; many, very fine and fine roots; clear and smooth transition to:
Bt1 22-40 cm	Dark reddish brown (5 YR 4.5/6 dry, 2.5 YR 3/4 moist); sandy clay; weak, very fine and fine subangular blocky structure; loose when dry, friable when moist, sticky and plastic when wet; few, thin clay cutans, many, very fine pores; many, very fine and fine roots; clear and wavy transition to:
Bt2 40-95 cm	Dark reddish brown (2.5 YR 3/6 dry, 2.5 YR 2.5/4 moist); clay; moderate, medium and coarse prismatic breaking down to moderate, medium and coarse subangular blocky structure; very hard when dry, friable when moist, sticky and plastic when wet; few, thin clay cutans; few, thin slickensides; common, very fine, few, fine pores; moderately calcareous; few, fine and medium roots; gradual and smooth transition to:
Bt3k 95-130 cm	Dark reddish brown (2.5 YR 3/6 dry, 2.5 YR 2.5/4 moist); clay; moderate, very coarse prismatic breaking down to weak, coarse to very coarse angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few, thin clay cutans; few, thin slickensides; few, very fine pores; strongly calcareous; soft powdery lime spots; very few very fine roots.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 13.

Mapping unit: Pf 1.2. Soil classification: Calcari-haplic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 22	7.8	7.4	0.17	--	--	0.10	--	--	20.0	12.8	5.7	2.55	2.9	24	100+	14
Bt1	22- 40	8.3	7.5	0.16	--	--	0.34	--	--	24.0	22.0	8.3	1.95	2.4	35	100+	10
Bt2	40- 60	8.8	7.6	0.50	--	--	0.22	--	--	26.4	16.4	8.3	1.80	4.2	31	100+	16
Bt2	60- 95	8.7	7.9	1.45	--	--	0.16	--	--	28.4	18.0	10.3	1.96	9.0	39	100+	32
Bt3k	95-130	8.7	7.8	3.50	--	--	0.16	--	--	25.5	12.8	8.9	1.80	11.4	35	100+	45

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 22	50	7	43	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
22- 40	46	7	47	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
40- 60	44	6	50	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60- 95	36	8	56	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
95-130	38	4	58	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-30 cm)

pH-H2O (1:2.5 v/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
7.9	0.10	--	6 0.	84	1.54	10.0	7.4	0.62	76

X-ray report on clay mineralogy

A- and Bt1 horizons: illite and kaolinite with traces of montmorillonite in Bt2 and Bt3k horizons.

PROFILE DESCRIPTION No. 14.

Observation: C1; Tana River District; Bura West; 8-3-85.

Ap 0-18 cm	Dark red (5 YR 5/8 dry, 2.5 YR 3/6 moist); clay; weak, very fine, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine pores; many, very fine roots; clear and smooth transition to:
AB 18-36 cm	Dark red (2.5 YR 3/6 moist); clay; weak, very fine, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, stick and plastic when wet; many, very fine and fine pores; slightly calcareous; common, very fine and fine roots; clear and smooth transition to:
Bw1 36-84 cm	Dark reddish brown (2.5 YR 3/4 moist); clay; moderate, fine and medium, subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, common, medium pores; moderately calcareous; few, very fine roots; gradual and smooth transition to:
Bw2ck 84-155 cm	Dark reddish brown (2.5 YR 3/4 moist); clay; moderate medium to coarse, subangular blocky structure; friable when moist, sticky and plastic when wet; common, fine and medium pores; strongly calcareous; very few, very fine roots; 1% 2-5 mm thick calcium carbonate concretions;
Bw3ck 155-185 cm	Red (2.5 YR 4/8 moist); gravelly clay; friable when moist, sticky and plastic when wet; moderately calcareous; 5% 5-10 mm thick calcium carbonate concretions;
Bw4ck 185-225 cm	Yellowish red (5 YR 5/6 moist); gravelly clay; firm when moist, sticky and plastic when wet; strongly calcareous; over 15% 5-15 mm thick calcium carbonate concretions;
Bck 225 cm +	Petrocalcic horizon.

Note: The profile was augered from 155 cm.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 14.

Mapping unit: Pf 2.1. Soil classification: Chromi-calcaric CAMBISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Ap	0- 18	8.0	7.4	0.19	--	--	0.37	--	--	25.6	14.4	4.7	3.8	0.6	23.5	92	2
AB	18- 36	7.9	7.4	0.13	--	--	0.16	--	--	23.6	22.0	7.1	5.0	0.3	34.4	100+	1
BW1	36- 60	8.0	7.1	0.13	--	--	0.26	--	--	28.4	22.0	10.8	4.0	0.6	37.4	100+	2
BW1	60- 84	8.7	7.7	0.40	--	--	0.23	--	--	26.0	22.0	9.7	3.8	4.4	39.9	100+	17
BW2ck	84-110	9.0	8.0	0.40	--	--	0.22	--	--	25.1	23.0	9.3	3.5	5.6	41.4	100+	22
BW2ck	110-155	9.0	7.7	0.50	--	--	0.24	--	--	23.6	21.0	9.7	3.5	7.3	41.5	100+	31

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 18	46	6	48	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18- 36	40	6	54	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
36- 60	34	8	58	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60- 84	38	8	54	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
84-110	38	6	56	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
110-155	34	8	58	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-18 cm)

pH-H2O (1:2.5 v/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.1	0.37	--	6	0.80	1.72	13.0	8.0	0.69	28

X-ray report on clay mineralogy

Ap-, AB- and Bw1 horizons: mainly illite, illite and traces of kaolinite and montmorillonite at 84-110 and 110-155 cm respectively.

PROFILE DESCRIPTION No. 15.

Observation: S1-1; Tana River District, Bura West; 28-2-85.

Au1 0-15 cm	Yellowish red (5 YR 4/6 dry, moist); clay; weak, very fine crumb structure; hard when dry, friable when moist, slightly sticky and slightly plastic when wet; strongly calcareous; many, very fine and fine roots; clear and wavy transition to:
Au2 15-24 cm	Dark reddish brown (2.5 YR 3/6 dry, 2.5 YR 3/4 moist); clay; weak, very fine subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; strongly calcareous; many, very fine and fine roots; clear and smooth transition to:
Bw1 24-70 cm	Dark reddish brown (2.5 YR 3/4 dry moist); clay; moderate, medium prismatic breaking down into fine to medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides; strongly calcareous; common, very fine roots; gradual and smooth transition to:
Bw2k 70-102 cm	Dark reddish brown (2.5 YR 3/4 dry, 2.5 YR 2.5/4 moist); clay; moderate, coarse prismatic breaking down into moderates fine to medium angular blocky structure; very hard when dry,firm when moist, sticky and plastic when wet; common, thin slickensides, strongly calcareous; soft powdery lime and salt crystals; few, very fine roots; gradual and smooth transition to:
Bw3z 102-122 cm	Reddish brown (5 YR 4/6 dry, 5 YR 4/4 moist); clay; firm when moist, sticky and plastic when wet; common, thin slickensides; strongly calcareous; many salt crystals; clear and smooth transition to:
BCg 122-150 cm	Dark reddish grey (5 YR 5/2 dry, 5 YR 4/2 moist); common, fine, distinct, reddish brown (5 YR 4/6 dry, 5 YR 4/4 moist) mottles; clay; firm when moist, sticky and plastic when wet; moderately calcareous; clear and smooth transition to:
Cg 150-170 cm	Dark greyish brown (10 YR 5/3 dry, 10 YR 4/2 moist); common, reddish brown (5 YR 5/3 dry, 5 YR 4/2 moist) mottles; clay; firm when moist, sticky and plastic when wet; moderately calcareous.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 15.

Mapping unit: P1 2.2. Soil classification: Chromi-calcaric CAMBISOL

Horizon	Depth in cm	pH-H2O (1:2.5%)	pH-KCl (1:2.5%)	EC (1:2.5%) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Au1	0- 15	8.3	7.6	0.15	--	--	0.70	--	--	30.5	28.0	8.3	2.7	1.1	40.0	100+	4
Au2	15- 24	8.7	7.6	0.27	--	--	0.41	--	--	32.6	33.0	9.5	2.3	4.2	49.0	100+	13
BW1	24- 70	8.6	7.6	2.10	--	--	0.16	--	--	40.0	21.0	8.3	1.7	8.2	47.5	100+	20
BW2k	70-102	8.4	7.8	8.00	--	--	0.16	--	--	37.1	26.0	8.7	2.1	13.5	49.3	100+	36
BW3k	102-122	8.4	7.7	7.00	--	--	0.17	--	--	37.6	18.0	9.1	1.9	16.6	45.6	100+	44
BCg	122-150	8.5	7.7	6.00	--	--	0.16	--	--	40.0	19.0	8.7	2.2	18.5	48.4	100+	43

Texture-Limited Pretreatment				Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 15	40	4	56	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15- 24	38	6	56	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
24- 70	32	4	64	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
70-102	24	6	70	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
102-122	24	6	70	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
122-150	24	6	70	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-18 cm)

pH-H2O (1:2.5%)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.5	0.41	--	2	1.64	0.40	38.0	7.6	0.08	20

X-ray report on clay mineralogy

Traces of illite and kaolinite.

PROFILE DESCRIPTION No. 16.

Observation: G4; Tana River District; Bura West; Acres/ILACO, 1967.

Ack 0-18 cm	Dark reddish brown (5 YR 3/4 moist); sandy clay; moderate, medium crumb structure; soft when dry, slightly sticky and slightly plastic when wet; few roots; common, fine calcium carbonate concretions; slightly calcareous; clear and wavy transition to:
Bt1ck 18-69 cm	Dark reddish brown (5 YR 3/4 moist); clay; weak, coarse prismatic structure; very hard when dry, firm when moist, sticky and plastic when wet; few calcium carbonate concretions; abundant spots of soft powdery lime; strongly calcareous; some clay cutans; gradual and smooth transition to:
Bt2ck 69-135 cm	Dark reddish brown (5 YR 3/4 moist); clay; massive; extremely hard when dry, firm when moist, sticky and plastic when wet; few calcium carbonate concretions; abundant spots of soft powdery lime; strongly calcareous; some clay cutans; fine salt crystals; gradual and smooth transition to:
Bt3ck 135-170 cm	Dark reddish brown (5 YR 3/4 moist); clay; massive; slightly hard when dry, firm when moist, sticky and plastic when wet; few calcium carbonate concretions stained with manganese oxides; few spots of soft powdery lime; strongly calcareous, some clay coatings; common fine salt crystals.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 16.

Mapping unit: Pf 2.4. Soil classification: Calcari-haplic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5%/v)	pH-KCl (1:2.5%/v)	EC (1:2.5%/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Ack	0- 18	8.6	8.0	0.41	0.25	0.0	0.76	0.07	10.9	25.2	11.8	4.7	4.0	0.8	21.3	85	3
Btlck	18- 69	9.9	7.9	0.6	8.1	0.0	--	--	--	20.0	12.0	6.1	1.0	10.7	29.8	100+	38
Bt2ck	69-135	9.1	8.1	3.4	8.5	0.01	--	--	--	36.4	10.9	10.9	0.8	13.5	36.1	99	37
Bt3ck	135-170	9.2	7.9	3.2	6.5	0.01	--	--	--	38.0	9.7	9.9	0.9	16.8	37.3	98	47

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 18	52	6	42	SC	36	--	2.4	--	--	--	--	--	--	--	--	--	--	--
18- 69	38	8	54	C	63	--	1.9	--	--	--	--	--	--	--	--	--	--	--
69-135	38	8	54	C	74	--	22.9	--	--	--	--	--	--	--	--	--	--	--
135-170	28	10	62	C	91	--	18.4	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-18 cm)

pH-H2O (1:2.5%/v)	C %	NX	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
--	--	--	--	--	--	--	--	--	--

X-ray report on clay mineralogy

PROFILE DESCRIPTION No. 17.

Observation: B16; Tana River District, Bura West; Acres/ILACO 1967.

A 0-25 cm	Reddish brown (5 YR 4/4 moist); clay; weak crumb structure; soft when dry, friable when moist, sticky and plastic when wet; many roots; strongly calcareous; abrupt and smooth transition to:
Bu1k 25-76 cm	Yellowish red (5 YR 4/6 moist); clay; strong coarse prismatic structure; hard when dry, firm when moist, sticky and plastic when wet; few roots; thin slickensides; common, fine calcium carbonate concretions; common pockets of soft powdery lime; strongly calcareous; clear and smooth transition to:
Bu2k 76-142 cm	Yellowish red (5 YR 4/6 moist); clay; moderate coarse, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few slickensides; common, fine calcium carbonate concretions stained with manganese oxides; few pockets of soft powdery lime; strongly calcareous; abrupt and smooth transition to:
Bu3k 142-178 cm	Yellowish red (5 YR 4/6 moist); clay; moderate coarse angular blocky structure; very hard when dry, firm when moist and sticky and plastic when wet; abundant slickensides; common, fine calcium carbonate concretions; common, fine salt crystals.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 17.

Mapping unit: Pf 3.1. Soil classification: Chromi-calcic VERTISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 25	8.7	7.6	0.21	5.1	0	0.73	0.08	9.1	29.9	19.6	5.5	2.9	0.4	28.4	95	1
Bwk	25- 76	9.5	7.7	0.65	9.7	0	--	--	--	35.0	12.9	11.3	1.0	9.5	34.7	99	27
Bw2k	76-142	9.1	7.9	3.7	8.5	0	--	--	--	39.2	10.8	9.6	1.3	16.9	38.6	98	43
Bw3k	142-178	8.8	7.9	4.0	6.4	0	--	--	--	42.0	11.7	9.0	1.5	18.9	41.1	98	45

	Texture-Limited Pretreatment				Saturation Extract							anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 25	37	10	53	C	51	--	1.1	--	--	--	--	--	--	--	--	--	--	--
25- 76	31	10	59	C	72	--	2.2	--	--	--	--	--	--	--	--	--	--	--
76-142	25	12	63	C	79	--	25.2	--	--	--	--	--	--	--	--	--	--	--
142-178	25	10	65	C	84	--	28.5	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-20 cm)

pH-H2O (1:2.5 v/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.9	0.73	0.08	--	1.65	0.44	22.0	9.6	0.38	60

X-ray report on clay mineralogy

PROFILE DESCRIPTION No. 18.

Observation: GU2-1; Tana River District, Bura West; 28-2-85.

A 0-15 cm	Dark reddish brown (5 YR 3/3 dry, 5 YR 3/2 moist); clay; weak, very fine and fine subangular blocky structure; loose and soft when dry, friable when moist, slightly sticky and slightly plastic when wet; many, very fine and fine pores; strongly calcareous; many, very fine and fine, common, medium roots; clear and smooth transition to:
Bu1 15-40 cm	Dark reddish brown (5 YR 3/3 dry/moist); clay; moderate, medium, prismatic structure breaking into moderate, fine to medium angular and subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides; common, very fine and fine, few, medium pores; strongly calcareous; common, fine, few, medium roots; gradual and smooth transition to:
Bu2 40-112 cm	Dark reddish brown (5 YR 3/3 dry/moist); clay; weak, coarse and very coarse angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides; few, very fine and fine pores; strongly calcareous; very few, very fine roots.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 18.

Mapping unit: Pf 3.2. Soil classification: Chromi-haplic VERTISOL

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 15	8.2	7.5	0.24	--	--	1.28	--	--	36.6	26.0	6.5	2.0	2.9	37	100	8
Bw1	15- 40	8.4	7.6	0.85	--	--	0.19	--	--	39.5	28.0	10.2	1.6	6.5	46	100+	16
Bw2	40- 80	8.7	7.7	4.0	--	--	0.23	--	--	40.0	28.0	10.1	2.0	11.7	52	100+	29
Bw2	80-112	8.5	7.6	4.0	--	--	0.15	--	--	38.6	22.0	9.3	2.0	13.5	47	100+	35

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 15	46	7	47	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
15- 40	42	5	53	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
40- 80	38	7	55	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
80-112	36	7	57	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-20 cm)

pH-H2O (1:2.5 v/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.7	1.28	--	3	2.50	0.40	36.0	8.8	0.20	40

X-ray report on clay mineralogy

A-, Bw1- and Bw2 horizons: montmorillonite, illite and traces of kaolinite.

PROFILE DESCRIPTION No. 19.

Observation: Pit no 17[a]; Tana River District, Hola Irrigation Scheme; 5-3-85; Irrigated part of extension area.

Ap 0-18 cm	Dark brown (7.5 YR 4/4 dry, 7.5 YR 3/4 moist); sandy clay; weak, fine and medium subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, few, medium pores; moderately calcareous; many, very fine and fine, common, medium roots; clear and smooth transition to:
AB 18-46 cm	Brown to dark brown (7.5 YR 4/4 dry/moist); sandy clay; weak, coarse and very coarse angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; many, very fine, common fine, few, medium pores; moderately calcareous; few, fine roots; clear and wavy transition to:
Bulk 46-85 cm	Dark reddish brown (5 YR 3/3 dry/moist); sandy clay; weak, coarse and very coarse prismatic structure breaking into moderate, medium to very coarse angular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides; many, very fine, common fine, few medium pores; strongly calcareous; 4-5% 5 mm thick calcium carbonate concretions; gradual and wavy transition to:
Bu2g 85-160 cm	Dark reddish brown (5 YR 3/3 moist); few, fine, faint yellowish brown (10 YR 5/6) mottles; clay; moderate, medium and coarse angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few thin slickensides; common, very fine and fine pores; strongly calcareous; some spots of soft powdery lime.
BCg 160-200 cm	Dark brown (10 YR 3/3 moist); few, fine faint yellowish brown (10 YR 5/6) mottles; clay; sticky and plastic when wet; slightly calcareous.
2C1 200-230 cm	Brown to dark brown (10 YR 4/3 moist); sandy clay; sticky and plastic when wet; non-calcareous;
2C2 230-300 cm	Dark yellowish brown (10 YR 4/4 moist); sandy clay loam; sticky and plastic when wet; non-calcareous.

Note: augered from 160 cm.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 19.

Mapping unit: Pt 1. Soil classification: Calcari-gleyic CAMBISOL

Horizon	Depth in cm	pH-H2O (1:2.5%/v)	pH-KCl (1:2.5%/v)	EC (1:2.5%/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 18	8.4	7.8	0.20	--	--	1.17	--	--	27.6	16.0	6.1	3.0	2.4	27.5	99	9
AB	18- 46	8.4	7.7	0.13	--	--	0.77	--	--	22.5	22.0	6.3	2.8	1.2	32.3	100	5
Bwlk	46- 85	8.9	8.0	0.21	--	--	0.79	--	--	24.0	25.0	11.1	4.9	2.3	43.3	100	9
Bw2g	85-160	10.0	8.9	0.60	--	--	0.58	--	--	24.8	20.0	10.3	1.0	9.9	41.2	100	40
BCg	160-200	9.9	8.9	0.50	--	--	0.53	--	--	24.0	22.0	10.8	1.2	12.0	45.2	100	50
2C1	200-230	9.8	8.9	0.60	--	--	0.91	--	--	18.8	17.0	8.3	0.9	8.9	35.1	100	47

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 18	52	7	41	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
18- 46	54	7	39	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
46- 85	46	9	45	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
85-160	42	7	51	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
160-200	42	7	51	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
200-230	56	5	39	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-18 cm)

pH-H2O (1:2.5%/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.2	1.17	--	5	1.21	0.36	24.0	8.0	0.64	40

X-ray report on clay mineralogy

Traces of illite, montmorillonite and kaolinite.

PROFILE DESCRIPTION No. 20.

Observation: Pit 12; Tana River District, Hola Irrigation Scheme; 4-3-85; Irrigated area - Block I1 area II.

Ap 0-19 cm	Dark brown (7.5 YR 4/4 dry, 7.5 YR 3/2 moist); sandy clay/clay; porous massive slightly hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine pores; strongly calcareous; clear and wavy transition to:
Bt1 19-51 cm	Dark brown (7.5 YR 4/4 dry, 7.5 YR 3/4 moist); sandy clay /clay; weak medium to coarse, subangular blocky struct- ure; hard when dry, friable when moist, sticky and plastic when wet; few, thin slickensides; many, very fine and fine, few, medium pores; slightly calcareous; clear and wavy transit- ion to:
Bt2k 51-97 cm	Dark brown (10 YR 3/3 dry, moist); sandy clay/clay; weak medium to coarse, prismatic, breaking into moderate coarse and very coarse, moderate angular blocky structure; firm when moist, sticky and plastic when wet; few, thin slickensides; few, very fine, fine and medium pores; strongly calcareous;pockets of soft powdery lime; diffuse and wavy transition to:
Bt3 97-180 cm	Dark brown to brown (10 YR 5/4 dry, 10 YR 4/3 moist); clay; weak fine and medium, subangular blocky structure; firm when moist, sticky and plastic when wet; common, thin slicken- sides; few, very fine, fine and medium pores; strongly calcareous;
BC 180-210 cm	Dark brown (7.5 YR 4/4 moist); clay; moderately calcareous;
C1 210-300 cm	Dark brown (7.5 YR 4/4 moist); clay; moderately calcareous;
C2k 300-320 cm	Strong brown (7.5 YR 5/6 moist); gravelly clay; strongly calcareous; pockets of soft powdery lime;
C3 320-350+ cm	Strong brown (7.5 YR 5/6 moist); clay; moderately calcar- eous.

Note: Profile augered from 150 cm onwards.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 20.

Mapping unit: Pt 1. Soil classification: Calcari-haplic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mohos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Ap	0- 19	8.0	7.1	0.35	--	--	1.55	--	--	29.9	23.0	6.5	2.4	2.3	34.2	100+	8
Bt1	19- 51	8.1	6.9	0.12	--	--	0.52	--	--	19.2	17.0	6.5	2.4	1.1	27.0	100+	6
Bt2k	51- 97	9.1	7.7	0.45	--	--	0.89	--	--	23.0	22.0	9.7	1.3	4.4	37.4	100	19
Bt3	97-180	9.4	8.0	1.00	--	--	0.13	--	--	22.0	12.0	6.5	1.0	9.7	29.2	100	44
BC	180-210	9.4	8.4	1.20	--	--	0.12	--	--	18.7	10.5	6.9	1.1	15.1	33.6	100	81
C1	210-300	9.3	8.0	2.00	--	--	0.52	--	--	25.2	14.0	7.1	1.3	14.7	37.1	100	58

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mohos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 19	58	3	39	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
19- 51	54	7	39	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
51- 97	48	9	43	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
97-180	46	7	47	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
180-210	41	8	51	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
210-300	41	6	53	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-19 cm)

pH-H2O (1:2.5 v/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.1	1.55	--	2	1.64	0.58	28.0	7.4	0.88	30

X-ray report on clay mineralogy

Ap- and Bt1 horizons: traces of illite and kaolinite; Bt2k and Bt3: montmorillonite occurs.

PROFILE DESCRIPTION No. 21.

Observation: Pit 1; Tana River District, Hola Irrigation Scheme; Irrigated area; 2-3-85.

Ap 0-20 cm	Strong brown (7.5 YR 4/6 moist); clay; weak, fine and medium subangular blocky structure; friable when moist, sticky and plastic when wet; strongly calcareous; very few, very fine roots; clear and smooth transition to:
Bu1 20-58 cm	Dark reddish brown (5 YR 3/4 moist); clay; moderate medium and coarse, prismatic structure breaking into moderate fine and medium, angular blocky structure; firm when moist, sticky and plastic when wet; few, thin slickensides; few, very fine and fine pores; strongly calcareous; very few, very fine roots; clear and smooth transition to:
Bu2z 58-80 cm	Yellowish red (5 YR 4/6 moist); clay; moderate fine and medium, subangular blocky structure; friable when moist, sticky and plastic when wet; common, thin slickensides; many very fine and fine, few, medium pores; strongly calcareous; few, fine salt crystals; very few, very fine roots; clear and wavy transition to:
Bu3z 80-125 cm	Brown to dark brown (10 YR 4/3 moist); clay; moderate very fine and fine, angular blocky structure; friable when moist, sticky and plastic when wet; common, thin slickensides; common, very fine and fine, few, medium pores; strongly calcareous; few, fine salt crystals; very few, very fine roots; diffuse and smooth transition to:
Bu4 125-170 cm	Dark greyish brown (10 YR 4/2 moist); clay; moderate, very fine and fine, subangular blocky structure; firm when moist, sticky and plastic when wet; common, thick slickensides; few, very fine pores; strongly calcareous; very few, very fine roots;
BC 170-270 cm	Greyish brown (10 YR 5/2 moist); clay; firm when moist; sticky and plastic when wet; slightly calcareous.

Note: Augered from 170 cm.
Cracks less than 1 cm wide were observed extending from the Ap-horizon into the Bu1-horizon.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 21.

Mapping unit: Pt 3. Soil classification: Calcari-Vertic CAMBISOL

Horizon	Depth in cm	pH-H20 (1:2.5%/v)	pH-KCl (1:2.5%/v)	EC (1:2.5%/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Ap	0- 20	7.8	7.1	0.25	--	--	1.55	--	--	29.8	30.0	10.3	2.9	2.9	54.1	100+	10
Bw1	20- 58	8.5	7.5	0.50	--	--	0.29	--	--	32.3	28.0	11.7	2.2	8.2	50.1	100+	25
Bw2z	58- 80	8.6	7.1	1.90	--	--	0.26	--	--	30.5	39.0	9.7	2.2	7.6	58.5	100+	25
Bw3z	80-125	8.4	7.1	1.65	--	--	0.54	--	--	41.7	36.0	10.8	2.0	7.6	56.4	100+	18
Bw4	125-170	8.8	7.4	0.75	--	--	0.54	--	--	37.5	26.0	10.5	2.1	13.0	51.6	100+	35
BC	170-270	8.9	7.8	0.65	--	--	0.13	--	--	24.2	18.0	8.7	1.7	10.7	39.1	100+	44

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 20	32	11	57	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20- 58	30	7	63	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
58- 80	26	9	69	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
80-125	22	5	73	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
125-170	22	7	71	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
170-270	30	7	63	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-20 cm)

pH-H20 (1:2.5%/v)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.4	1.55	--	2	1.98	0.32	28.0	10.2	0.04	23

X-ray report on clay mineralogy

Traces of montmorillonite, illite and kaolinite.

PROFILE DESCRIPTION No. 22.

Observation: Pit 15; Tana River District, Hola Irrigation Scheme; 5-3-85.

A 0-36 cm	Dark brown (7.5 YR 5/6 dry, 7.5 YR 3/4 moist); sandy clay loam to sandy clay; weak, fine and medium subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, few, medium pores; many, very fine and fine, few, medium roots; clear and wavy transition to:
Btlk 36-95 cm	Dark brown (7.5 YR 4/4 dry, 7.5 YR 3/4 moist); clay; moderate, coarse to very coarse, prismatic structure breaking into moderate fine and medium, angular blocky structure; hard when dry, friable to firm when moist, sticky and plastic when wet; few, thin slickensides/cutans; strongly calcareous; less than 5% pockets of soft powdery lime; few, very fine, fine and medium roots; diffuse and wavy transition to:
Bt2 95-134 cm	Brown to dark brown (7.5 YR 5/4 dry, 7.5 YR 4/4 moist); clay; moderate, fine, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides/cutans; many, very fine, few, fine pores; strongly calcareous; diffuse and wavy transition to:
Bt3 134-194 cm	Brown (7.5 YR 5/4 dry/moist); clay; moderate, fine, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides; few, very fine and fine pores; strongly calcareous;
BCk 194-204+ cm	Dark yellowish brown (10 YR 4/4 moist); clay; sticky and plastic when wet; slightly calcareous; 1% 2 to 3 mm thick $CaCO_3$ concretions.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 22.

Mapping unit: Pt 4. Soil classification: Calcari-haplic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5%)	pH-KCl (1:2.5%)	EC (1:2.5%) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
A	0- 36	7.8	7.4	0.60	--	--	1.47	--	--	31.6	16.4	3.5	2.0	2.9	24.8	79	9
Btlk	36- 95	7.8	7.2	0.60	--	--	0.25	--	--	32.0	24.0	10.5	1.0	5.4	40.9	100+	17
Bt2	95-134	8.9	7.7	0.55	--	--	0.16	--	--	40.0	26.0	11.5	1.1	16.5	55.1	100+	41
Bt3	134-194	8.6	7.8	6.50	--	--	0.16	--	--	38.0	18.0	10.5	1.2	14.7	44.4	100+	39
BCk	194-204	8.7	7.7	5.0	--	--	0.21	--	--	40.0	11.2	8.3	1.0	16.1	46.4	100+	40

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 36	50	6	44	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
36- 95	38	6	56	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
95-134	30	6	64	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
134-194	28	8	64	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
194-204	28	12	60	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-36 cm)

pH-H2O (1:2.5%)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
7.7	1.47	--	6	1.70	1.12	15.0	6.8	0.65	48

X-ray report on clay mineralogy

Illite and traces of kaolinite and montmorillonite.

PROFILE DESCRIPTION No. 23.

Observation: Pit 9; Tana River District, Hola Irrigation Scheme; 5-3-85.

Ap 0-23 cm	Yellowish brown (10 YR 6/6 moist); sandy clay; porous massive; slightly hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, common, medium pores; slightly calcareous; clear and wavy transition to:
Bt1 23-52 cm	Dark brown (10 YR 3/4 moist); clay; weak medium, prismatic breaking down to moderate fine and medium, subangular blocky structure; hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides/clay cutans; common very fine and fine pores; strongly calcareous; gradual and wavy transition to;
Bt2k 52-91 cm	Dark brown (10 YR 3/3 moist); clay; weak medium and coarse,prismatic breaking into weak medium to coarse, subangular and angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides/clay cutans; few, very fine and fine pores; strongly calcareous; pockets of soft powdery lime; diffuse and smooth transition to:
Bt3k 91-128 cm	Dark yellowish brown (10 YR 4/4 moist); clay; moderate fine to medium, angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; many, thin slickensides; few, very fine and fine pores; strongly calcareous; few pockets of soft powdery lime, common, fine carbonate nodules; diffuse and smooth transition to:
BC 128-180 cm	Dark yellowish brown (10 YR 4/4 moist); clay; moderate very fine and fine, moderate subangular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; common, moderately thick slickensides; few, very fine and fine pores; strongly calcareous.
C1 180-255 cm	Yellowish brown (10 YR 5/4 moist); clay; moderately calcareous;
C2 255-285 cm	Yellowish brown (10 YR 5/4 moist); clay; moderately calcareous;
C3 285-325 cm	Yellowish brown (10 YR 5/4 moist); clay; moderately calcareous.

Note: Profile augered from 180 cm onwards.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 23.

Mapping unit: Pt 5. Soil classification: Calcari-haplic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5%)	pH-KCl (1:2.5%)	EC (1:2.5%) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Ap	0- 23	8.0	7.2	0.25	--	--	1.20	--	--	25.0	16.6	6.5	2.2	4.0	29.1	100+	19
Bt1	23- 52	9.2	7.9	1.40	--	--	0.52	--	--	20.0	22.0	9.3	1.4	8.5	41.2	100+	42
Bt2k	52- 91	8.9	7.6	4.00	--	--	0.26	--	--	17.5	23.0	9.0	1.4	11.1	44.5	100+	63
Bt3k	91-128	9.3	8.0	1.40	--	--	0.53	--	--	18.0	13.2	8.1	1.2	11.3	33.8	100+	63
BC	128-180	8.7	7.8	6.00	--	--	0.62	--	--	21.6	13.2	8.0	1.3	14.0	36.5	100+	65
C1	180-255	8.6	7.7	7.00	--	--	0.06	--	--	19.5	11.2	8.3	1.4	9.7	30.6	100+	50
C2	255-285	8.7	7.7	7.00	--	--	0.01	--	--	21.6	9.6	6.5	1.2	11.5	28.8	100+	53
C3	285-325	8.8	7.7	6.00	--	--	0.02	--	--	19.8	11.2	8.3	1.5	8.6	29.6	100+	43

	Texture-Limited Pretreatment			Saturation Extract									anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 23	55	2	43	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
23- 52	41	6	53	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
52- 91	41	4	55	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
91-128	39	6	55	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
128-180	41	4	55	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
180-255	39	6	55	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
255-285	39	6	55	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
285-325	35	6	59	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-23 cm)

pH-H2O (1:2.5%)	C %	N%	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.2	1.20	--	4	1.30	0.69	24.0	9.8	0.62	43

X-ray report on clay mineralogy

Traces of illite and kaolinite.

PROFILE DESCRIPTION No. 24.

Observation: Pit 10; Tana River District, Hola Irrigation Scheme; Field no. L1, area II; 4-3-85.

Ap 0-20 cm	Dark brown (10 YR 4/3 dry, 10 YR 3/3 moist); sandy clay; weak, fine and medium, subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; many, very fine and fine, common, medium pores; moderately calcareous; common, very fine and fine roots; clear and smooth transition to:
AB 20-50 cm	Dark brown (7.5 YR 3/2 moist); sandy clay; weak, medium prismatic structure breaking into moderate, fine and medium subangular blocky peds; hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides/pressure faces; common, very fine and fine pores; strongly calcar eous; few, fine roots; gradual and smooth transition to:
Btlk 50-102 cm	Brown to dark brown (10 YR 4/3 moist); clay; moderate, medium to coarse prismatic structure breaking into moderate, fine and medium angular blocky peds; hard when dry, firm when moist, sticky and plastic when wet; common, thin slickensides/clay cutans; few, very fine and fine pores; strongly calcareous; about 5% 5-10 mm thick carbonate nodules; some pockets of soft powdery lime; clear and smooth transition to:
Bt2 102-200 cm	Dark brown (10 YR 3/3 moist); clay; moderate, medium and coarse prismatic structure breaking into moderate, fine and medium angular blocky peds; hard when dry, firm when moist; sticky and plastic when wet; common, moderately thick slickensides/clay cutans; few, very fine and fine pores; strongly calcareous;
BC 200-320 cm (augered)	Yellowish brown (10 YR 5/4 moist); clay; hard when dry, firm when moist, sticky and plastic when wet; moderately calcareous.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 24.

Mapping Unit: Pt 6. Soil classification: Calcari-mollic SOLONETZ

Horizon	Depth in cm	pH-H2O (1:2.5 v/v)	pH-KCl (1:2.5 v/v)	EC (1:2.5 v/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Ap	0- 20	7.9	6.8	0.20	--	--	0.93	--	--	26.5	16.0	3.7	1.8	0.8	22.3	84	3
AB	20- 50	8.3	7.2	0.22	--	--	0.27	--	--	29.2	26.0	4.3	1.4	1.9	33.6	100+	6
Btlk	50-102	9.1	7.6	0.80	--	--	0.16	--	--	40.0	28.0	7.5	1.4	9.7	46.6	100+	24
Bt2	102-150	9.3	8.2	0.90	--	--	0.06	--	--	32.5	20.0	5.3	1.4	13.6	40.3	100+	42
Bt2	150-200	9.4	8.2	1.05	--	--	0.06	--	--	30.0	13.6	4.3	1.4	17.1	36.4	100+	57
BC	200-320	9.3	8.2	1.25	--	--	0.05	--	--	29.8	12.8	4.3	1.6	13.6	32.3	100+	47

	Texture-Limited Pretreatment			Saturation Extract								anions in me/litre						SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 20	50	4	46	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20- 50	50	4	46	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--
50-102	36	8	56	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
102-150	34	6	60	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
150-200	34	6	60	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
200-320	26	6	68	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-23 cm)

pH-H2O (1:2.5 v/v)	C %	N %	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.3	0.93	--	2	1.74	0.32	36.0	8.8	0.02	13

X-ray report on clay mineralogy

Ap- and AB horizons: illite and kaolinite; Btlk: montmorillonite; Bt2 illite and traces of montmorillonite.

PROFILE DESCRIPTION No. 25.

Observation: Pit 8; Tana River District, Hola Irrigation Scheme; non-irrigated; 4-3-85.

Au1 0-10 cm	Dark yellowish brown (10 YR 4/6 dry, 10 YR 3/4 moist); clay loam to clay; weak, very fine and fine crumb structure; soft when dry, friable when moist, sticky and plastic when wet; many,very fine pores; strongly calcareous; common, very fine and fine roots; clear and smooth transition to:
Au2 10-20 cm	Dark reddish brown (7.5 YR 4/4 dry, 5 YR 3/3 moist); clay; weak, very fine and fine subangular blocky structure; slightly hard when dry, friable when moist, sticky and plastic when wet; common, very fine and fine pores; 1-2 cm wide cracks; strongly calcareous; few, very fine and fine roots; clear and wavy transition to:
Bu1k 20-44 cm	Dark reddish brown (5 YR 3.5/3 dry, 5 YR 3/3 moist); clay; moderate, medium to coarse prismatic structure breaking into subangular blocky peds; hard when dry, friable to firm when moist, sticky and plastic when wet; common, very fine and fine, few, medium pores; 1-2 cm wide cracks; strongly calcareous; 5% $CaCO_3$ nodules; gradual and smooth transition to:
Bu2k 44-110 cm	Dark reddish brown (5 YR 3/3 dry/moist); clay; moderate, coarse and very coarse prismatic structure breaking into moderate, medium and coarse angular blocky peds; very hard when dry, firm when moist, sticky and plastic when wet; common, thin slickensides; few, very fine and fine pores; calcium carbonate concretions/nodules; 1-2 cm wide cracks; strongly calcareous; gradual and smooth transition to:
Bu3 110-150 cm	Dark reddish grey (5 YR 4/2 moist); clay; angular blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; many, moderate slickensides; few, very fine pores; 1-2 cm wide cracks; strongly calcareous;
C1 150-200 cm	Dark yellowish brown (10 YR 3/4 moist); clay; very hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous;
C2 200-280 cm	Dark yellowish brown (10 YR 3/4 moist); clay; very hard when dry, firm when moist, sticky and plastic when wet; strongly calcareous;
C3 280-310 cm	Brown to dark brown (10 YR 4/3 moist); sandy clay; hard when dry, firm when moist, sticky and plastic when wet; moderately calcareous.

Note: Profile augered from 150 cm onwards.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 25.

Mapping Unit: Pt 7. Soil classification: Chromi-haplic VERTISOL

Horizon	Depth in cm	pH-H2O (1:2.5%/v)	pH-KCl (1:2.5%/v)	EC (1:2.5%/v) mmhos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Au1	0- 10	8.4	7.7	0.21	--	--	1.35	--	--	30.0	24.0	5.4	1.2	1.6	32.2	100	5
Au2	10- 20	8.3	7.7	1.05	--	--	1.45	--	--	32.0	33.0	8.7	1.5	3.4	46.6	100+	11
Bu1t	20- 44	8.7	7.9	3.50	--	--	0.39	--	--	29.5	23.0	9.3	1.6	10.9	44.8	100+	37
Bu2t	44-110	8.6	7.8	6.00	--	--	0.11	--	--	30.0	28.0	10.2	1.7	16.4	56.4	100+	55
Bu3	110-150	8.6	7.9	5.00	--	--	0.08	--	--	32.5	23.0	10.0	1.5	9.6	44.1	100	29
C1	150-200	8.6	7.5	4.00	--	--	0.03	--	--	30.0	6.2	8.3	2.8	4.8	22.1	73	16
C2	200-250	8.4	7.3	4.00	--	--	0.06	--	--	28.5	5.2	8.3	1.3	4.8	19.6	69	17
C2	250-280	8.4	7.6	6.0	--	--	0.15	--	--	30.0	15.2	6.1	1.3	11.8	34.4	100+	39
C3	280-310	8.8	7.9	4.0	--	--	0.07	--	--	16.4	8.4	6.5	0.9	8.9	24.7	100+	54

	Texture-Limited Pretreatment				Saturation Extract			cations in me/litre					anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mmhos/cm	Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 10	44	13	43	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10- 20	42	9	49	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
20- 44	36	8	57	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
44-110	30	9	61	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
110-150	26	9	65	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
150-200	22	11	67	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
200-250	22	11	67	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
250-280	26	11	63	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
280-310	52	5	43	SC	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-20 cm)

pH-H2O (1:2.5%/v)	C %	NI	P-Olsen (ppm)	Available nutrients (Mehlich et.al.,1962) Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm
8.3	1.40	--	8	1.08	0.84	28.0	9.2	0.54	91

X-ray report on clay mineralogy

Au1- and Au2 horizons: traces of illite and kaolinite. Bu1t-, Bu2t- and Bu3 horizons: predominantly montmorillonite.

PROFILE DESCRIPTION No. 26.

Observation: Pit 3; Tana River District, Hola Irrigation Scheme; non-irrigated, near block A area I; 2-3-85.

Au1 0-10 cm	Dark brown (10 YR 4/4 dry, 7.5 YR 4/4 moist); clay loam to clay; weak, very fine crumb structure; soft when dry, friable when moist, slightly sticky and slightly plastic when wet; many, very fine pores; strongly calcareous; common, very fine, few, medium roots; abrupt and wavy transition to:
Au2 10-25 cm	Dark brown (7.5 YR 3/4 dry/moist); clay; moderate, very fine and fine subangular blocky structure; hard when dry, friable when moist, sticky and plastic when wet; common, very fine pores; 5-10 mm wide cracks; strongly calcareous; few, very fine roots; gradual and smooth transition to:
Bu1 25-68 cm	Dark reddish brown (5 YR 3/3 moist); clay; weak, coarse prismatic structure breaking into moderate, medium to coarse angular blocky peds; very hard when dry, firm when moist, sticky and plastic when wet; few, thin slickensides; common, very fine pores; strongly calcareous; 5-10 mm wide cracks; gradual and smooth transition to:
Bu2k 68-100 cm	Dark reddish brown (5 YR 3/3 dry, 5 YR 3/2 moist); clay; moderate, coarse to very coarse prismatic structure breaking into moderate, medium to coarse angular blocky peds; extremely hard when dry, firm when moist, sticky and plastic when wet; common, thin slickensides; few, very fine pores; strongly calcareous; 5% 3-5 mm thick calcium carbonate concretions/nodules; few pockets of soft powdery lime; gradual and smooth transition to:
BCk 100-150 cm	Dark brown (10 YR 4/3 dry, 10 YR 3/3 moist); clay; moderate, coarse to very coarse prismatic structure breaking into moderate, fine to medium angular blocky peds; extremely hard when dry, firm when moist, sticky and plastic when wet; common, moderately thick slickensides; few, very fine pores; moderately calcareous; common pockets of soft powdery lime; gradual and smooth transition to:
C1 150-210 cm	Dark yellowish brown (10 YR 3/6 dry, 10 YR 3/4 moist); clay; extremely hard when dry, firm when moist, sticky and plastic when wet; moderately calcareous;
2C2 210-250 cm	Dark yellowish brown (10 YR 5/4 dry, 10 YR 4/4 moist); sandy clay loam; firm when moist, sticky and plastic when wet; moderately calcareous;
2C3 250-310 cm	Brown to dark brown (10 YR 5/4 dry, 10 YR 4/3 moist); loamy sand to sandy loam; strongly calcareous.

ANALYTICAL DATA OF PROFILE DESCRIPTION NO. 26.

Mapping unit: Pt 8. Soil Classification: Chromi-calcic VERTISOL

Horizon	Depth in cm	pH-H2O (1:2.5%/v)	pH-KCl (1:2.5%/v)	EC (1:2.5%/v) mohos/cm	CaCO3 %	CaSO4 %	C %	N %	C/N ratio	CEC (me/100g) pH 8.2	Exchangeable cations (me/100g) Ca	Mg	K	Na	Sum of cations	Base saturation	ESP
Au1	0- 10	8.5	7.4	0.22	--	--	0.83	--	--	25.5	18.6	13.5	2.0	4.0	38.1	100+	16
Au2	10- 25	8.9	7.5	0.60	--	--	0.68	--	--	21.7	20.0	14.5	1.5	5.3	41.3	100+	24
Bu1	25- 60	9.1	7.9	1.30	--	--	0.31	--	--	20.0	16.9	12.0	1.4	9.5	39.8	100+	47
Bu2k	60-100	8.8	7.7	4.50	--	--	0.35	--	--	24.9	22.6	13.4	1.5	9.7	47.2	100+	39
BCk	100-150	8.9	7.7	3.50	--	--	0.31	--	--	25.0	12.7	13.0	1.4	10.2	37.3	100+	41
C1	150-210	8.7	7.6	4.00	--	--	0.24	--	--	22.0	20.1	15.9	1.1	5.0	42.1	100+	23
2C2	210-250	9.1	7.8	3.0	--	--	0.16	--	--	10.2	15.2	12.8	0.7	3.1	31.8	100+	30
2C3	250-310	9.2	8.0	1.70	--	--	0.28	--	--	7.1	7.5	5.4	0.4	3.5	16.8	100+	49

	Texture-Limited Pretreatment				Saturation Extract								anions in me/litre					SAR
Depth in cm	Sand % 2.0-0.05 mm	Silt % 0.05-0.002 mm	Clay % 0.002-0 mm	Texture class	Moisture %	pH-paste	ECe mohos/cm	cations in me/litre Na+	K+	Ca++	Mg++	Sum	CO3--	HCO3-	Cl-	SO4--	Sum	
0- 10	42	10	48	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
10- 25	38	8	54	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
25-60	34	8	58	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
60-100	24	10	66	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
100-150	24	10	66	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
150-210	26	14	60	C	--	--	--	--	--	--	--	--	--	--	--	--	--	--
210-250	65	5	30	SCL	--	--	--	--	--	--	--	--	--	--	--	--	--	--
250-310	78	2	20	SL	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Fertility aspects (0-25 cm)				Available nutrients (Mehlich et.al.,1962)						X-ray report on clay mineralogy
pH-H2O (1:2.5%/v)	C %	N%	P-Olsen (ppm)	Na me/100g	K me/100g	Ca me/100g	Mg me/100g	Mn me/100g	P ppm	
8.1	0.83	--	10	2.10	0.40	38.0	7.0	0.21	23	Traces of montmorillonite, illite and kaolinite.