# Reference soil Kenya 67: Kastanozem

## Description

Location: Kajiado district. Themeda triandra is dominant grass species. Slides: 10,225 - 10,228.

## Classification

### WRB 2006:

Luvic calcic horizon Vertic Kastanozem (Hyposodic Clayic)
15-90 cm argic horizon
secondary carbonates
vertic properties

### WRB 1998:

Luvi- Hypocalcic Kastanozem (Hyposodic)

### FAO-UNESCO-ISRIC 1988:

Hypocalci- Luvic Kastanozem sodic phase

0-35 cm mollic A horizon
15-90 cm argic B horizon
soft powdery lime
vertic properties

### FAO-UNESCO 1974:

Luvic Kastanozem sodic phase
0-35 cm mollic A horizon
15-90 cm argillic B horizon
soft powdery lime
vertic properties

## Site description

### General information:

| | |
|---|---|
| Names of person(s) who described the profile | : Kuyper J & S Mwangi |
| General description of location of profile (e.g., town, province) | : Kajiado District,plateau near Manyatta Muranya, 5km S of Olyangalani school |
| Date | : November 1985 |
| Latitude / Longitude | : S -1.7944444º / E 36.7889º |

### Physiography:

| | |
|---|---|
| The altitude of the soil profile relative to mean sea level, specified in meters | : 1765 m asl |
| Regional landform | : plain |
| Topography of the surrounding country | : undulating |
| Physiographic Unit in the immediate surrounding of the site | : gently undulating plain |
| The slope refers to the inclination of the | : 3 % |

| | |
|---|---|
| land immediately surrounding the site. The measured or estimated slope angle is specified to the nearest per cent | |
| The physiographic position of the site where the profile is located | : upper slope |
| Form of the slope surrounding the site | : convex |
| Slope Aspect of the site | : |

## Parent material:

| | |
|---|---|
| The main parent rock/ material over which the soil has been formed (1st entry) | : tuff |
| Mode of Accumulation or deposition of parent material (1st entry) | : residual material |
| Texture of parent material (1st entry) | : clayey |
| Weathering status of solid rock (1st entry) | : highly |
| Resistance against weathering (solid rock) (1st entry) | : poor |
| Depth1 of lithological boundary | : cm |
| The main parent rock/ material over which the soil has been formed (2nd entry) | : |
| Resistance against weathering (solid rock) (2nd entry) | : |
| Soil Depth; depth to which roots can easily penetrate throughout the year | : 90 cm |
| Remarks on Parent Materials | : Olorgesailie biotite phonolite |

## Hydrology and drainage:

| | |
|---|---|
| Depth of groundwater table | : cm |
| Groundwater Top | : cm |
| Groundwater Bottom | : cm |
| Kind of groundwater table | : no groundwater table observed |
| Top Stagnating Layer | : 15 cm |
| Bottom Stagnating Layer | : 70 cm |
| Runoff | : medium |
| Flooding frequency | : never |
| Estimated permeablity (class) of least permeable part of the profile | : slow |
| Drainage Class | : imperfect |
| To Drainage Class | : |
| Moisture conditions of the profile: dry from -to | : 0-120 cm |
| Moisture conditions of the profile: moist from -to | : cm |
| Wet From - To | : cm |

## Land use / vegetation:

| | |
|---|---|
| Current land use at the site | : semi-natural grassland, grazed |
| Major crops | : |
| Main type of irrigation | : |
| Rotation scheme | : crop rotation scheme not relevant |
| Vegetation Type;The natural vegetation at the site | : medium tall grassland |
| Status of vegetation | : degraded |
| Remarks on Land Use / Vegetation | : VEGETATION: Natural grasslands; dominant grass species Themeda triandra |

## Erosion and aggredation:

| | |
|---|---|
| Soil erosion type (1st entry) | : |
| Occurrence of soil aggradation | : absent |
| Slope Stability | : stable |

## Surface characteristics:

| | |
|---|---|
| Microrelief type: small-scale differences in relief in the direct vicinity of the site | : |
| Microrelief Pattern | : none |
| Microrelief Height | : |
| Rockiness | : none |
| Stoniness | : stony |
| Average size of stones | : 5 |
| Shape of stones (on average) | : angular irregular |
| Cracks | : small cracks (width less than 1 cm, or depth less than 50 cm) |
| Slaking of aggregates by tillage, rainfall or frost | : surface partly slaked, round smooth aggregates |
| Evidence of salt | : non-saline |
| Evidence of alkali | : non-alkaline |

## Nearest climate station:

| | |
|---|---|
| Station | : Kajiado DC office |
| Country | : Kenya |
| WMO Code | : 9999 |
| Distance | : 10 km SE (good ) |
| Latitude / Longitude | : S 1º50 / E 36º48 |

## Climate data*:

| dataType(Station) | : nrecord | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Annual |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Precipitation (mm)(Kajiado DC office) | : 42 | 43 | 42 | 67 | 119 | 62 | 12 | 4 | 3 | 7 | 21 | 65 | 59 | 504 |

*Data are considered representative for site

## Profile description:

| | | |
|---|---|---|
| Ah<br>0-5 cm | : | black (7.5YR 2/0, moist) grey (10YR 5/1, dry), silty clay, strong fine and medium crumb, slightly hard friable sticky very plastic, many very fine pores and few fine pores, many very fine and few fine roots, non calcareous, gradual smooth boundary to, |
| AB<br>5-15 cm | : | black (2.5Y 2/0, moist) black (2.5Y 2/0, dry), silty clay, strong fine and medium crumb and strong fine subangular blocky, hard friable sticky very plastic, many very fine pores and few fine pores, many very fine and few fine roots, non calcareous, clear wavy boundary to, |
| Bth<br>15-35 cm | : | black (2.5Y 2/0, moist) black (10YR 2/1, dry), clay, strong medium prismatic parting to strong fine and medium angular blocky, very hard firm sticky plastic, continuous thin clay and humus cutans on horizontal and vertical pedfaces, many very fine pores and few fine pores, many very fine and few fine roots, moderately calcareous (2-10%), gradual smooth boundary to, |
| Bt<br>35-60 cm | : | very dark grey (2.5Y 3/0, moist) black (10YR 2/1, dry), clay, strong very coarse prismatic, very hard firm sticky plastic, continuous moderately thick clay cutans on horizontal and vertical pedfaces, many very fine pores and few fine pores, many very fine and few fine roots, moderately calcareous (2-10%), gradual smooth boundary to, |
| Bci<br>60-70 cm | : | dark greyish brown (2.5Y 4/2, dry) very dark grey (10YR 3/1, moist), clay, moderate coarse angular blocky, hard friable sticky plastic, patchy moderately thick slickensides, many very fine pores and few fina and medium pores, many very fine roots, moderately calcareous (2-10%), clear smooth boundary to, |
| Ckc1<br>70-90 cm | : | light yellowish brown (2.5Y 6/4, dry) dark greyish brown (2.5Y 4/2, moist), clay, weakly coherent massive parting to moderate fine subangular blocky, slightly hard friable sticky plastic, many very fine pores and few fine pores, many very fine and few fine roots, very few medium irregular soft calcareous concretions, moderately calcareous (2-10%), gradual smooth boundary to, |
| Ckc2<br>90-120 cm | : | light yellowish brown (2.5Y 6/4, dry) dark greyish brown (2.5Y 4/2, moist), clay, weakly coherent massive parting to moderate fine subangular blocky, slightly hard friable sticky plastic, many very fine pores and few fina and medium pores, many very fine roots, very few medium irregular soft calcareous concretions, moderately calcareous (2-10%), gradual smooth boundary to, |
| Ckc3<br>120-140 cm | : | weak red (2.5YR 4/2, moist) brown (10YR 5/3, dry), sandy clay loam, weakly coherent massive, slightly hard (dry) friable (moist) sticky plastic, common large irregular hard calcareous concretions, strongly calcareous (10-25%), |

## Physical

## Particle size distribution:

| Depth (cm) | | Gravel (%) | Very Coarse Sand (%) | Coarse Sand (%) | Medium Sand (%) | Fine Sand (%) | Very Fine Sand (%) | Total Sand (%) | Coarse Silt (%) | Fine Silt (%) | Total Silt (%) | Clay (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-5 | : | 1 | 1.2 | 1.9 | 3.4 | 6.8 | 4.4 | 17.7 | 11.5 | 25.2 | 36.7 | 45.6 |
| 5-15 | : | 1 | 0.2 | 1.5 | 2.5 | 6.5 | 2.4 | 13.1 | 9.3 | 14.8 | 24.1 | 62.8 |
| 15-35 | : | 0 | 0.2 | 0.7 | 1.3 | 2.5 | 1.7 | 6.4 | 2.4 | 10.2 | 12.6 | 81.0 |
| 35-60 | : | 0 | 0.2 | 0.7 | 1.1 | 2.4 | 1.1 | 5.5 | 4.6 | 13.5 | 18.1 | 76.5 |
| 60-70 | : | 0 | 0.2 | 0.7 | 1.2 | 2.1 | 1.4 | 5.6 | 3.6 | 22.0 | 25.6 | 68.8 |
| 70-90 | : | 0 | 0.2 | 0.4 | 0.8 | 1.9 | 0.9 | 4.2 | 0.6 | 15.1 | 15.7 | 80.2 |
| 90-120 | : | 0 | - | - | - | - | - | - | - | - | - | - |
| 120-140 | : | 20 | - | - | - | - | - | - | - | - | - | - |

## Other physical data

| Depth (cm) | | Bulk Density (kg/dm³) | Spec. Surf. Area (m2/g) | COLE (cm/cm) | Water Disp. Clay (%) | Clay (%) |
|---|---|---|---|---|---|---|
| 0-5 | : | - | - | - | - | 45.6 |
| 5-15 | : | - | - | - | - | 62.8 |
| 15-35 | : | - | - | - | - | 81.0 |
| 35-60 | : | - | - | - | - | 76.5 |
| 60-70 | : | - | - | - | - | 68.8 |
| 70-90 | : | - | - | - | - | 80.2 |
| 90-120 | : | - | - | - | - | - |
| 120-140 | : | - | - | - | - | - |

## Chemical characteristics:

| Depth (cm) | | pH H2O | pH KCl | EC 1 : 2.5 (mS/cm) | CaCO3 (%) | Org. C (%) | Org. N (%) | C / N | Exch. Acid (cmol/kg) | Exch. Al (cmol/kg) | Ca (cmol/kg) | Mg (cmol/kg) | K (cmol/kg) | Na (cmol/kg) | Sum Cations (cmol/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-5 | : | 6.2 | 5.1 | 0.12 | - | 3.10 | 0.24 | 13 | - | - | 23.0 | 9.6 | 4.9 | 0.1 | 37.6 |
| 5-15 | : | 6.3 | 5.0 | 0.18 | - | 2.12 | 0.19 | 11 | - | - | 24.2 | 9.7 | 5.6 | 0.3 | 39.8 |
| 15-35 | : | 6.6 | 5.1 | 0.21 | 2.3 | 1.41 | 0.14 | 10 | - | - | 27.7 | 10.4 | 7.1 | 0.7 | 45.9 |
| 35-60 | : | 7.3 | 5.7 | 0.17 | 2.6 | 1.09 | 0.13 | 8 | - | - | 30.4 | 10.8 | 7.8 | 1.3 | 50.3 |
| 60-70 | : | 7.6 | 6.1 | 0.27 | 3.2 | 0.98 | - | - | - | - | 32.6 | 11.3 | 8.3 | 1.8 | 54 |
| 70-90 | : | 7.9 | 6.7 | 0.74 | 3.8 | 0.80 | 0.09 | 9 | - | - | 34.2 | 12.4 | 9.3 | 2.8 | 58.7 |
| 90-120 | : | 7.8 | 6.8 | 1.22 | 4.0 | 0.72 | 0.09 | 8 | - | - | 33.6 | 13.0 | 9.7 | 4.0 | 60.3 |
| 120-140 | : | 7.9 | 7.1 | 1.69 | 9.6 | 0.32 | 0.02 | 16 | - | - | 52.1 | 12.2 | 10.0 | 4.8 | 79.1 |

| Depth (cm) | | CEC Soil (cmol/kg) | CEC Clay (cmol/kg) | CEC Org (cmol/kg) | ECEC (cmol/kg) | Base sat. (%) | Al sat. (%) | ESP (%) |
|---|---|---|---|---|---|---|---|---|
| 0-5 | : | 42.2 | 73 | 10.9 | - | 89 | - | 0 |
| 5-15 | : | 44.6 | 62 | 7.4 | - | 89 | - | 1 |
| 15-35 | : | 48.5 | 57 | 4.9 | - | 95 | - | 1 |
| 35-60 | : | 48.8 | 62 | 3.8 | - | 103 | - | 3 |
| 60-70 | : | 51.0 | 73 | 3.4 | - | 106 | - | 4 |
| 70-90 | : | 50.1 | 175 | 2.8 | - | 117 | - | 6 |
| 90-120 | : | 48.2 | 196 | 2.5 | - | 125 | - | 8 |
| 120-140 | : | 44.2 | 204 | 1.1 | - | 179 | - | 11 |

## Clay mineralogy:

| Depth (cm) | | Kaolinite | Mica / illite | Vermiculite | Chlorite | Smec | Halloysite | Mixed layer | Quar | Feldspar | Gibbsite | Goethite | Hematite |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0-5 | : | very weak | weak to medium | - | - | - | - | weak | - | - | - | - | - |
| 5-15 | : | - | - | - | - | - | - | - | - | - | - | - | - |
| 15-35 | : | very weak | weak to medium | - | - | - | - | weak | - | - | - | - | - |
| 35-60 | : | - | - | - | - | - | - | - | - | - | - | - | - |
| 60-70 | : | very weak | weak to medium | - | - | - | - | weak | - | - | - | - | - |
| 70-90 | : | - | - | - | - | - | - | - | - | - | - | - | - |
| 90-120 | : | - | - | - | - | - | - | - | - | - | - | - | - |
| 120-140 | : | very weak | weak to medium | - | - | - | - | weak | - | - | - | - | - |

## Source of analyzing procedures:

| Laboratory | Attribute | Description | Proc. ref |
|---|---|---|---|
| ISRIC | Base sat. | Calculation; Sum of Exchangeable Cations (Na, K, Ca, Mg) / CEC soil | labmanual |
| ISRIC | C / N | Calculation; Organic Carbon / Organic Nitrogen | labmanual |
| ISRIC | Ca | Exchangeable bases with 1 M ammonium acetate at pH 7; Ca by atomic absorption spectrometry | 9-4 and 9-5.3 |
| ISRIC | CaCO3 eq. | Carbonates are dissolved with dilute HCl. Residual acid is titrated. Carbonates expressed as CaCO3 | 7 |
| ISRIC | CEC Clay | Calculation; ((CEC soil - CEC org.m.)/ clay %)*100 | 9-6.3 |
| ISRIC | CEC Org | CEC organic matter; expert estimate for charge per unit C | 9-6.3 |
| ISRIC | CEC Soil | CEC; with index cation in buffered solution pH7 | 9-4 and 9-5.3.3 |
| ISRIC | Clay; < 0.002 mm | Fraction by Pipette analysis; after removal CaCO3 and organic matter, dispersion and sedimentation | 3-4.7 |
| ISRIC | EC 1 : 2.5 | Electro Conductivity of a soil / water (1:2.5) suspension | 4-1.4 and 13-4 |
| ISRIC | ESP | Calculation; (Exchangeable Na / CEC soil) * 100 | 9-6.3 |

| | | | |
|---|---|---|---|
| ISRIC | Gravel | Fraction from field sample, after drying, crushing, sieving | **1-1** |
| ISRIC | K | Exchangeable bases with 1 M ammonium acetate at pH 7; K by flame atomic emission spectrometry | **9-6.1** |
| ISRIC | Kaolinite | Kaolinite; relative abundance scale 0 - 7 | **16-1** |
| ISRIC | Mg | Exchangeable bases with 1 M ammonium acetate at pH 7; Mg by atomic absorption spectrometry | **9-4 and 9-5.3** |
| ISRIC | Mica / Illite | Mica / ilitele; relative abundance scale 0 - 7 | **16-1** |
| ISRIC | Mixed-layer | Mixed layer minerals; relative abundance scale 0 - 7 | **16-1** |
| ISRIC | Na | Exchangeable bases with 1 M ammonium acetate at pH 7; Na by flame atomic emission spectrometry | **9-4 and 9-5.3** |
| ISRIC | Organic Carbon | Wet combustion of organic matter by potassium dichromate and sulphuric acid at about 125 degrees Celcius. Residual dichromate is back titrated against ferrous sulphate. To compensate for incomplete destruction an emprical correction factor of 1.3 is applied | **5** |
| ISRIC | Organic Nitrogen | Organic Matter is digested in sulphuric acid (and hydrogen peroxide) with selenium as catalyst. Nitrogen is converted to ammonium sulphate. The solution is made alkaline and ammonia is distilled off. The evolved ammonia is trapped in boric acid and titrated with standardized acid solution | **6** |
| ISRIC | pH H2O | pH electrode; in supernatant suspension | **4** |
| ISRIC | pH KCl | In supernatant suspension; potentiometrically | **4-1** |
| ISRIC | Sand; 0.10 - 0.05 mm | Fraction by sieving; after removal CaCO3 and organic matter | **3-4.6** |
| ISRIC | Sand; 0.25 - 0.10 mm | Fraction by sieving; after removal CaCO3 and organic matter | **3-4.6** |
| ISRIC | Sand; 0.5 - 0.25 mm | Fraction by sieving; after removal CaCO3 and organic matter | **3-4.6** |
| ISRIC | Sand; 1.0 - 0.5 mm | Fraction by sieving; after removal CaCO3 and organic matter | **3-4.6** |
| ISRIC | Sand; 2.0 - 0.05 mm | Total sand fractions by sieving; after removal CaCO3 and organic matter | **3-5** |
| ISRIC | Sand; 2.0 - 1.0 mm | Fraction by sieving; after removal CaCO3 and organic matter | **3-4.6** |
| ISRIC | Silt; 0.02 - 0.002 mm | Fraction by Pipette analysis ; after removal CaCO3 and organic matter, dispersion and sedimentation | **3-4.7** |
| ISRIC | Silt; 0.05 - 0.002 mm | Calculation; Sum fractions Silt 0.05 - 0.02 mm | **3-4.7** |
| ISRIC | Silt; 0.05 - 0.02 mm | Fraction by Pipette analysis ; after removal CaCO3 and organic matter, dispersion and sedimentation | **3-4.7** |
| ISRIC | Sum cations | Sum of Exchangeable Cations (Ca, Mg, Na, K) with 1 M ammonium acetate at pH 7 | **9-** |

*ref: no labmanual available, link to presumable used analytical methode

## Other classification

**USDA-NRCS (1999)** : Vertic Argiustoll
**USDA-SCS (1975)** : Vertic Argiustoll clayey isothermic
**Classification (other)** :
Verti-luvic phaeozem