

Observation and description of soil profile

Text for the Farmer-led Extension Method course of JICA (2014)

1. Purpose

Soil supports the life and ecosystem on earth. Soil was formed in extremely long periods of time. It is easy to destroy the soil, but it is impossible to create it again. It is necessary to protect soil and use it carefully in order to keep our natural ecosystem, and produce healthy food for our human life permanently.

Soil profile is a face of soil. It changes from soil to soil reflecting the climate conditions, biological activity, vegetation, land shape, parent materials, and so on. It records also the past human activity, incidents of volcanic ash fall, aerial dusts. From the very recent experience, we became aware that the soil profile records the sediments of Tsunami deposits and also the pollution by radioactivity. Therefore, it is necessary to observe the soil profile in the field to know the individual characteristics of the soil and to understand the role of soil in the environmental preservation and agricultural production.

From the view of soil diagnosis, observation of the soil profile helps understanding the constraints in crop production and helps to establish proper countermeasures to improve the soil fertility.

2. How the soil profile observation is carried out.

- 1) Select the site which represents the objective area. Mark the site on a map. Record the vegetation and land-use. Weather of the day and the date are also recorded.
- 2) Prepare a soil pit and shape out a soil profile.
- 3) Take the photo of the profile.
- 4) Divide a soil profile into different layers (horizons) according to the soil color, hardness, and stickiness (soil texture).
- 5) Name the soil layers (horizons) according to a proper guidebook..
- 6) Test each soil layer in the order of soil hardness, soil color, soil texture, and soil macro-fabric structure.

3. How to dig a soil pit.

- 1) Dimensions of a soil pit are around 1 m width, 1.0 – 2 m length, and 1.0 – 1.5 m depth. Soil profile for observation should be vertical and make some steps on the opposite side of the profile.

- 2) Soils dug out from the pit should be placed on plastic sheets aside a pit. Soils of surface layers and subsurface layers should be placed separately. Do not place the soil above the soil profile.
- 3) Shape out the soil profile. Cut the roots of tree and grass with scissors and saws. Make the surface of soil profile flat with a h and shovel. This work should be done from the upper to lower layers. The surface need not be completely flat. Leave the soil macro-fabric structure, clods and stones un-disturbed. Leave also a short length of roots coming out from the soil profile.
- 4) Photo taking. Place a ruler on the left side of the profile. The ruler should be colored every 10 cm red and white (or black and white) alternately. A card with the name of site and date should be placed on the top of the profile. Direct sunlight on the soil profile should be avoided. In case it is not avoided, make shadows by umbrella, sheets or several people standing against the profile.
- 5) Avoid using a strobe light or electronic flash to take the natural feeling of the surface.

4. Dividing layers and giving names to layers.

Divide the soil profile into several layers according to the soil color, hardness, stickiness (soil texture) and mottles.

Names of the layers are like: O (O_i, O_e, O_a), A (A_p, A₁, A₂), B (B_w, B_t), C and R.

5. Observation and description of the soil profile.

1) Overlying organic matter layer (O layer)

O_i: Lying in the surface. Fallen leaves and twigs are undecomposed.

O_e: Below O_i. Original shapes of leaves and twigs are lost but partial structure is still recognizable.

O_a: Organic matter is well decomposed and the original structure can not be recognized.

2) Humus (Soil organic matter) content in the mineral layer.

division	Humus %	Lightness value
few	< 2 %	5 - 7
common	2 - < 5 %	4 - 5
abundant	5 - < 10 %	2 - 3
Very abundant	10 - < 20 %	1 - 2
Organic layer	>20 %	< 2

Lightness value: according to Soil Color Chart (Munsell)

3) Soil texture

Soil texture is determined by the composition of sand, silt and clay. It is judged in the field by rubbing the wet soil between fingers.

Soil texture judged in the field

Soil texture	Feeling
Sandy soil	Feel only sand. Not sticky.
Sandy loam	Feel sand strongly. Stickiness is slightly recognized.
Loam	Feel sand moderately. Feel also stickiness. Feel sand and clay to the same extent.
Silt loam	Feel like wheat powder. Do not feel sand so much.
Clay loam	Slightly feel sand, but considerably sticky.
Light clay	Feel almost no sand. Very sticky.
Heavy clay	No sand. Very sticky.

4) Soil color

Soil color is determined by the soil color chart.

It is described by the combination of Hue, Value, and Chroma according to the Munsell color system,

5) Soil structure

Shapes	
Granular	Round shaped. Few pores. Hard.
Aggregate like	Round shaped. Easily broken by fingers. Many pores.
Angular blocky	Blocky shape with angular edges.
Sub-angular blocky	Blocky shape with round edges.
Columnar	Long like a column with round edges.
Prismatic	Long like a column with angular edges.
Platy	Platy structure oriented horizontally and stacked.
No structure	
Single granule	Like sand. Each particle is separated.
Wall-like	Soil layer is packed densely with no special structure.

6) Soil hardness

Soil hardness is measured by soil hardness meter (push cone type) or by finger pressing.

Soil hardness standards

	Meter Reading	Finger pressing
Very loose	< 10 mm	Feel no resistance to finger
Loose	11 – 18 mm	Finger can be pushed into soil layer with slight resistance.
Moderate	19 – 24 mm	Can be pushed into the first knuckle.
Dense	25 – 28 mm	No penetration of finger, but soil surface will be pressed with finger marks.
Very dense	> 29 mm	No penetration of finger, with no depression mark.

7) Soil wetness

Dry, Semi-dry, Semi-wet, Wet, Very wet, Extremely wet.

8) Activity of plants and animals

Plant roots

Soil animals

Remains of human-being ancestors

Examples of descriptions

Abundant in fine roots

Contain medium roots

Rich in earthworm paths

Expressions

No

Few

Common

Abundant

Translated terms are tentative. (Kiyoshi Tsutsuki)