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MEASURING SOIL TEXTURE IN THE FIELD

Physics

Key points

- Soil texture is a measure of the relative proportion of the various soil particle size fractions in soil.
- Soil texture affects the physical and chemical properties of a soil.
- Field texturing is a quick method of determining soil texture, and enables an immediate interpretation of texture down the soil profile.

Background

Soil texture is an estimate of the relative amounts of sand, silt and clay particles in a soil. The physical and chemical behaviour of a soil is influenced strongly by soil texture (Bowman & Hutka, 2002), which will vary due to the differences in the type and mineral composition of the parent material, the soils position in the landscape, and the physical and chemical weathering processes involved in soil formation. Soil texture affects the movement and availability of air, nutrients and water in a soil (Hunt and Gilkes, 1992) and is often used to estimate other soil properties, particularly soil water properties, if no direct measurements are available (NLWRA, 2001). A simple measure of soil texture is the way a soil feels when manipulated by hand.

Measuring soil texture

Field or hand texturing is a measure of the behaviour of a small handful of soil when moistened and kneaded into a ball slightly larger than the size of a golf ball (NSW Agriculture, 1988) or bolus and pressed out to form a ribbon between the thumb and forefinger (figure 1). The behaviour of the soil during bolus formation, and the ribbon produced, characterises the field texture.

Field method

Take a sample of soil and remove the >2mm fraction (gravel—see below, roots, organic material) by sieving or by hand. The sample should be sufficient to fit comfortably into the palm of your hand. Moisten the soil with a little water and knead it into a bolus (figure 1). Continue to work the bolus, adding more soil and water if necessary, until the soil no longer sticks to your fingers and there is no apparent change in plasticity (usually 1–2 minutes). If the bolus is worked for a long time it may dry but it can be re-wet (the moisture of the sample will influence the length of the ribbon formed).

Using a clean, moistened hand, place the bolus between your thumb and forefinger and slide your thumb across the soil (shearing) to extrude a ribbon. Try to make a thin continuous ribbon about 2 mm thick and 1 cm wide. Measure and record the length of the ribbon produced using a rule. Soils with high clay content are further categorised by moulding the bolus into rods. If the rods fracture the soil is assigned a texture grade lighter than a medium clay. A breakdown of field texturing categories is given in table 1. This method has been adapted from McDonald *et al.* (1998).

Gravel (particles >2 mm) is removed from the soil prior to texturing because it does not contribute to chemical and some physical properties of soils.

Laboratory method

A laboratory determination of soil texture gives a more detailed and reliable measure of the relative amounts of sand, silt and clay particles in a soil. The common term for measuring soil texture in the laboratory is particle size analysis (PSA). Particle size analysis determines particle size distribution (PSD) of a soil and while field texture is closely related to the PSD (McKenzie *et al.*, 2004), texture classes assigned from field texture and PSA are not always equivalent. For example, sodic soils have a heavier field texture than is suggested by the laboratory determined PSA. For a more detailed description of this method please refer to "Particle Size Analysis" fact sheet.

Figure 1: *Manipulation of soil for field texturing. The properties of each soil when doing this determines texture.*

Table 1: *Classification based on field texturing of soils. The combination of 'Behaviour of Moist Bolus' and 'Ribbon Length' gives an indication of 'Field Texture Grade'. Adapted from McDonald et al. (1998).*

Field Texture Grade	Behaviour of Moist Bolus	Ribbon Length (shearing between thumb and forefinger)	Approximate Clay Content (%)
Sand	Coherence nil to very slight, cannot be moulded; single sand grains adhere to fingers.	Nil	<10% (often <5%)
Loamy Sand	Slight coherence.	≈5 mm	5–10%
Clayey Sand	Slight coherence, sticky when wet; many sand grains stick to fingers; clay stains the hands.	5–15 mm	5–10%
Sandy Loam	Bolus just coherent but very sandy to touch; dominant sand grains are of medium size and are easily visible.	15–25 mm	10–20%
Loam	Bolus coherent and rather spongy; smooth feel when manipulated, no obvious sandiness or 'silkiness'; may be greasy to the touch if much organic matter is present.	≈25 mm	≈25%
Silty Loam	Coherent bolus; very smooth to silky when manipulated.	≈25 mm	≈25% (with silt)
Sand Clay Loam	Strongly coherent bolus, sandy to touch; medium size sand grains visible in finer matrix.	25–40 mm	≥25%
Clay Loam	Coherent plastic bolus, smooth to manipulate.	40–50 mm	20–30%
Clay Loam, Sandy	Coherent plastic bolus; medium size sand grains visible in finer matrix.	40–50 mm	30–35%
Silty Clay Loam	Coherent smooth bolus; plastic and often silky to the touch.	40–50 mm	30–35% (with silt)
Sandy Clay	Plastic bolus; fine to medium sand grains can be seen, felt or heard in clayey matrix.	50–75 mm	35–40%
Light Clay	Plastic bolus; smooth to touch.	50–75 mm (slight resistance to shear)	35–40%
Light Medium Clay	Plastic bolus; smooth to touch.	≈75 mm (slight–mod. resistance to shear).	40–45%
Medium Clay	Smooth plastic bolus; handles like plasticine; can be moulded into rods without fracture.	≥75 mm (mod. resistance to ribbon shear).	45–55%
Heavy Clay	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture.	≥75 mm (firm resistance to ribbon shear)	≥50%

Glossary terms

Bolus: the ball of soil formed by manipulating the soil by hand.
Coherence: the ball or bolus of soil holds together.
Parent material: weathered and unweathered rock or soil from which soil is formed.
Plasticity: the ball can be deformed and holds its new shape strongly; typical of clays.
Shearing: sliding the thumb across the soil to form a ribbon.
Silkiness: the smooth, soapy or slippery feel of silt.
Sodic: soils with a high level of exchangeable sodium (can lead to poor soil physical conditions).

Further reading and references

Bowman GM, Hutka J (2002) Particle Size Analysis. In 'Soil Physical Measurement and Interpretation for Land Evaluation' (Eds. NJ McKenzie, HP Cresswell, KJ Coughlan) pp 224-239. (CSIRO Publishing: Collingwood, Victoria).

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