# Know your soils

## Understanding Soil Texture

Pick up a handful of soil and you can feel how fine or coarse it is. That feel comes from the size and proportion of sand, silt and clay particles in the soil, and is known as the soil *texture*.

Clay (particles less than 0.002 mm in diameter) causes the soil to be more sticky and plastic. Silt (particles between 0.002 and 0.02 mm in diameter) gives the soil a silky smoothness. Sand (particles between 0.02 and 2 mm in diameter) causes the soil to feel gritty. Organic matter can make the soil feel spongy.

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### Soil texture influences:

- The amount of water that can be stored in the soil (water holding capacity)
- The rate of water and air movement through the soil (drainage, permeability, aeration)
- Soil nutrient supply (amount and availability)
- Ease of root growth
- Workability, trafficability (potential for compaction)
- Resistance to erosion
- Ability of a soil to maintain a stable pH

Soil texture can be measured by a laboratory (using tests called Particle Size Analysis or Particle Size Distribution) or it can be easily estimated in the field by observing the behaviour and 'feel' of a small handful of moist soil, kneaded into a ball and pressed into a ribbon. The feel of the soil ball and the length of the ribbon indicate the soil texture.

Soil scientists in Australia recognise about 15 types of field texture (e.g. sand, clayey sand, sandy loam, silty clay loam, light clay, heavy clay). A simpler approach is to break the soil into three general groups: sandy, loamy or clayey. Sandy soils do not form a ball when a moist sample is squeezed in the hand. Loamy soils will form a ball when moist, but will not form a ribbon more than 5 cm. Clayey soils form a ball when moist, and also form a ribbon more than 5 cm.

**Step 1:** Collect enough soil to fit comfortably into the palm of your hand. Crush any lumps of soil, and remove stones and plant material.

**Step 2:** Add water to the soil sample, a little at a time, and knead the soil to make a small ball (about 3–5 cm in diameter) that sticks together and is moist. Knead/work the ball for a minute or two (until there is no apparent change in the feel of the ball).

**Step 3:** Press the soil between your thumb and forefinger to make a ribbon. Attempt to keep the ribbon about 2 mm thick and continue ribboning until the ribbon breaks.

**Step 4:** Measure the length of ribbon. Compare results to the look-up table on the next page.

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**Table 1:** Look-up table to determine field texture of soils.

| TEXTURE GRADE | BEHAVIOUR OF MOIST SOIL | | APPROX. CLAY % |
|---|---|---|---|
| SAND | **FEEL**<br>**BALL**<br>**RIBBON** | Very sandy, no stickiness<br>Very fragile, falls apart easily<br>Will not ribbon | <5 |
| LOAM | **FEEL**<br>**BALL**<br>**RIBBON** | Slightly sandy, a bit spongy and 'greasy'<br>Smooth or spongy, holds together<br>About 2.5 cm | 25 |
| CLAY | **FEEL**<br>**BALL**<br>**RIBBON** | No sandy feel*, very sticky<br>Smooth, like plasticine, holds together strongly<br>5 to >7.5 cm | >35 |

*Coarse sand may sometimes be evident in soils of clay texture. If so, they may be described as 'sandy', for example, *sandy* light clay or *sandy* medium clay.

**Table 2:** A general guide to soil properties, based on soil texture.

| SOIL PROPERTY | SOIL TEXTURE | | |
|---|---|---|---|
| | *SAND* | *LOAM* | *CLAY* |
| Drainage | High | Medium | Poor |
| Water holding capacity | Low | Medium | High |
| Aeration | Good | Medium to Good | Poor |
| Compaction potential | Low | Medium | High |
| Resistant to pH change (buffering capacity) | Low | Medium | High |
| Nutrient supply (cation exchange capacity) | Low | Medium | High |
| Ability to retain chemicals and nutrients | Very Low | Low to Medium | Medium to High |
| Ease of cultivation | High | Medium | Low |
| Root penetration | Good | Good | Low |

For some soils, the texture remains the same throughout the profile (often called a *uniform soil*). For example, soils formed from basalt on the Darling Downs have a clay texture throughout their profile. Soils on sandhills in western Queensland have a sandy texture throughout their profile.

In other soils, the texture gets gradually heavier as you move from the top to the bottom e.g. clay loam at the surface to a light clay in the subsoil. These soils are often called *gradational soils*.

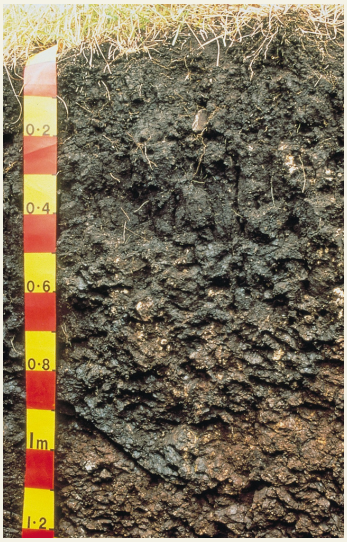


**Image 1:** A uniform black cracking clay from the Darling Downs.

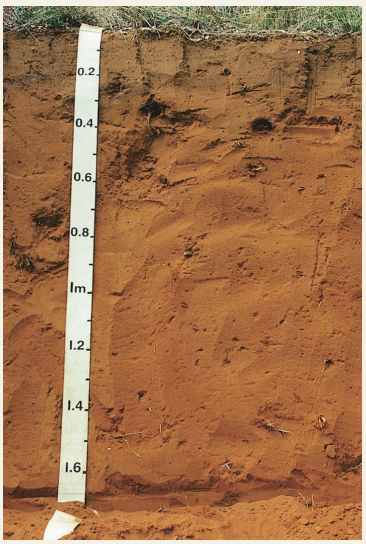


**Image 2:** A uniform red sand from Western Queensland.

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## Texture contrast soils

In some soils, texture changes abruptly between the surface soil and the subsoil e.g. sandy loam in the top 20 cm overlying a heavy clay. These soils are called *duplex soils* (or *texture contrast soils*) and have their own set of problems as you're effectively dealing with two different types of soil in the one hole. Plant roots have to cope with different conditions as they penetrate the soil. In many cases, the subsoil (bottom) clay layers are sodic and/or saline.

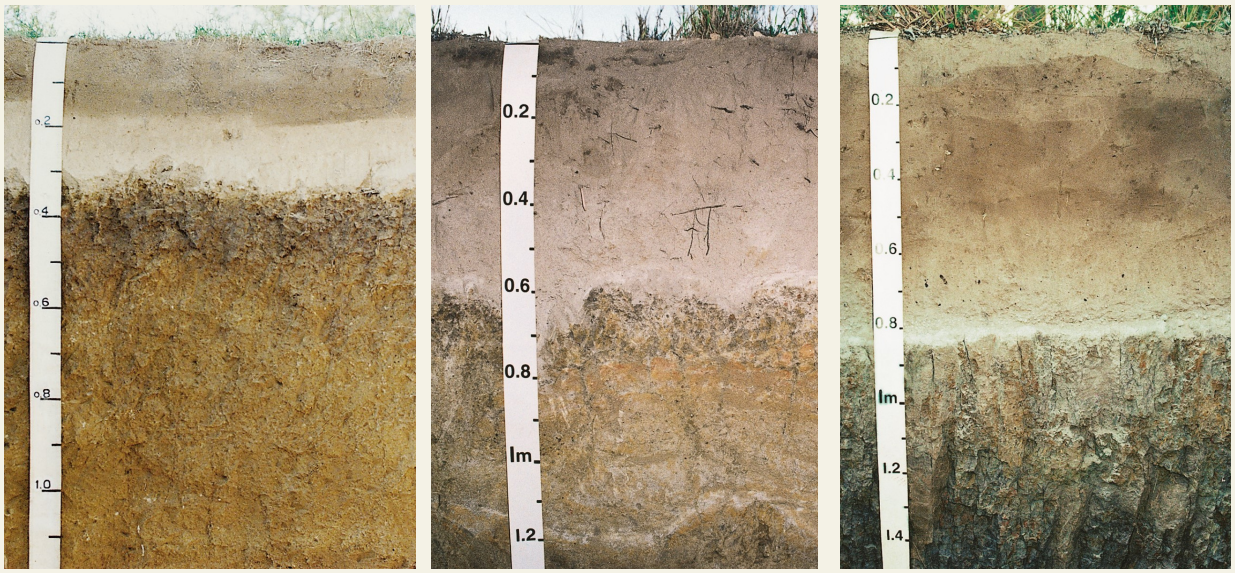


**Image 3:** Texture contrast soils have a sandier/light textured topsoil which overlies a clay/heavy textured subsoil (which is usually sodic and/or saline).

## Clay soils

Clays ain't clays. People ask "how do I fix my clay", "clay is no good—what can I add to make it better", but our best cropping land is on clays—and some of our best gully erosion is on clays too. This is because there are different types of clay found in soils. For example, the black cracking clay soils on the Darling Downs have a very high fertility and water holding capacity which makes them great for growing plants, but they also naturally shrink when dry, swell when wet and form cracks—which can be a farming challenge. The productive, red non-cracking clays on the Atherton Tablelands have about the same amount of clay as the black cracking clays (because they're both formed from basalt rocks), but it's a different type of clay which doesn't crack when dry. On the other hand, clays high in salts and/or sodium are very problematic and may be prone to erosion, making growing anything a challenge.

Possible problems encountered with clay soils include difficulty in digging, poor water penetration, poor root growth, waterlogging in wet weather, surface crust formation and cloddiness. These problems are caused by a lack of sand-sized particles, a high content of silt-sized particles, the types of clay minerals present, too much sodium, too little organic matter, or a combination of two or more of these. Solutions include adding gypsum and organic matter. Gypsum will only make a difference if your soil has too much sodium in it (there is an easy test to see if your soil has too much sodium in it—see the *Understanding Dispersive Soils* fact sheet).

## Other fact sheets in this series:

- Understanding Soil Colour
- Understanding Soil pH
- Understanding Soil Structure
- Understanding Soil Sodicity
- Understanding Dispersive Soils
- Understanding Soils from an Erosion Rehabilitation Perspective

For further information on soils, refer to the Queensland Government website at https://www.qld.gov.au/environment/land/soil/

**sqlandscapes.org.au**

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