



# Soil Tests



Continuing to explore the 2015 IY Soils and the environment in this series by Jeanie Clark

Science is often thought of as experiments, but observation about what exists comes first and is important at any age. Both types of science can be fun and informative. In keeping with this 2015 International Year of Soils (IYS) and its 'healthy soils for a healthy life' theme, this article will suggest some basic tests for (top) soils, so that they can be used at home or in natural places. The websites suggested vary in their level of complexity, but carry no advertisements.

### Soil Colour

If you haven't yet looked at the soil at your place with your children, then this is a very important science observation for the IYS. This activity can be taken further with a camera, colour matching and some experiments:

1. Take a camera and record your soil colour.
2. If you have a big set of colour pencils, try some matching – against a pencil colour-name!
3. Apply a standard colour chart to it, by referring to the 2008 Victorian Department of Primary Industries Practical Note on Soil Colour (on the web as PraeNote Colour.pdf) which provides two ways of identifying soil colours: as a triangular grid or from a more variegated Munsell Chart.

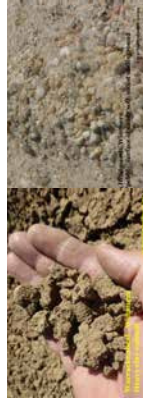
What causes soil colours? This PDF identifies four factors: minerals from the parent rock, humus from the decayed plant content, water and iron.

4. Try making your soil colour change. Take some of it and observe the difference as you add some water – not a flood! What is happening? Soil contains matter in three states: gas (air), liquid (water) and solids (the mineral and organic matter that most people think is all that soil is). The gas and liquid can't usually be seen but are present. When water is added to soil, it pushes the gas out and the higher water content makes the soil a darker shade.
- 5 If you don't have access to soil or want to look at some from other places for their varieties of colour (reds, whites, blacks and browns), then the growing collection of 'Soil Selfies' at <http://soils.enviroed4all.com.au/soil-selfies/> can be used for this. You may also like to add your soil to the collection.

### Soil Texture

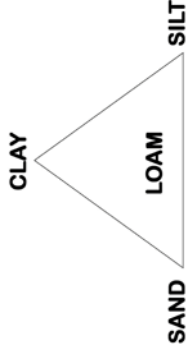
'Texture' is about what soil feels like, excluding temperature. It is due to the size of the particles that make up the soil. Look at the following photos.

The two soils look quite different. What adjectives would describe these differences? The soil on the left is chunky and hard; the one on the right is loose.



This difference is caused by their difference in individual soil particle, or grain, sizes, or 'texture'. On the left, the soil has particles so small that individual ones cannot be seen ('clay'), while those on the right are big enough to be seen ('sand').

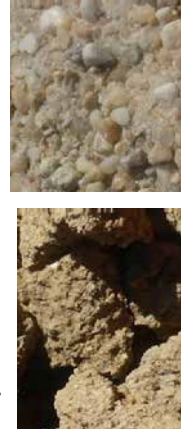
Clay and sand are words naming soil texture from its smallest to largest grain sizes. There are two more types between them as shown on this triangular grid - a simplified Soil Texture Diagram. (Google 'soil texture diagram' for greater detail.)



While some soils are pure clay or sand, in reality many are a mixture of sand, silt and clay. Loam, is the best in the middle of sand and silt, and with only 1/5th clay. So how can we observe texture?

### Zooming in

Our sense of sight can be enhanced with a magnifying glass, or zoomed photo, for example: Clay stuck in clods .....



### Separating soil layers

When mixed with water, the tiny clay particles make it muddy, while the larger heavier sand ones fall to the bottom. This difference can be used for a test to identify texture. It uses a see-through container in which soil is mixed with water and notices what happens as it settles. Layers form due to the texture

with sand at the bottom, and clay suspended in the water. Measurements of depth of each layer are converted to percentages which identify the soil texture type on a detailed Soil Texture Diagram.

There are several versions and levels of complexity of this test on the web. It is introduced with a clear diagram of relative grain sizes, and a simple guide to the method at <http://www.the-compost-gardener.com/soil-texture.html>. More detail is at [www.soil-net.com/](http://www.soil-net.com/) in their Case Studies section, choose the 'Soils and Water' section, then you can find 'Jam Jar'. Note the importance of a straight-sided container (plastic or glass) at least 10 cm high. A more complex version, is in the second project at <http://www.soil4kids.org/files/s4k/soil-texture-experiment.pdf>. The Colorado State Uni method adds detergent to break up the big clods of clayey soil at <http://www.ext.colostate.edu/mg/gardennotes/214.html>. It is also available as a pdf.

### Making balls and sausages

This one is a common garden test using the sense of touch, and getting hands dirty! Put some soil in your hand and add a little water so you can work it like playdough. Try to form a ball and then a sausage. No ball means mostly sand. The length of the ribbon shows the clay content. There are many charts to show all the gradings inbetween on the Soil Texture diagram. Gardening books often include this method and a grading chart, and there are many versions to be found on a web search. Typical ones are at the Colorado State Uni reference above and Landlearn's 'Soils ain't dirt' pdf booklet pp 17-18. Kansas State Uni provides a step-by-step YouTube demo at <https://www.youtube.com/watch?v=IOyaBxi767s>

### Modelling the spaces in soil

Texture affects the spaces between the particles in the soil. A suggestion for modelling different particle sizes is given as the fourth project at [www.soil-net.com/](http://www.soil-net.com/). A test to show this using filter papers (eg for coffee) and coloured water is at <http://www.doctordirt.org/teachingresources/soilfilter>. Further development of soil's spaces is at <http://www.doctordirt.org/teachingresources/idealsoil>. Models of amounts of water in soils is at <http://www.doctordirt.org/teachingresources/sponge>

### Soil acidity



Is the soil acidic, neutral or alkaline? The soil's organic and mineral contents affects its pH, but it is not something that can be seen. So, how can you find out what they are? There are pH soil tests kits and probes at hardware stores that will cost less than \$20. They include instructions and suggestions about what to add to bring your soil back to neutral if it is too acidic or alkaline.

### Soil salinity



### fresh marginal brackish saline Salinity

If you live in the Murray Darling Basin or along a coast, then your soil would have had salt in its geologic history, from being under sea water or blown over by winds from the sea. As with people, too much salt can be dangerous to plant health. Plant species vary in their ability to live with salt, so plant type can indicate salinity levels.

How much salt is in your soil? This test is more complex than earlier ones. You will need distilled water, a salinity scan (perhaps borrowed from your local Catchment Management Authority) and instructions from NSW Salinity Note 8 at <http://www.dpi.nsw.gov.au/agriculture/resources/soils/salinity/general/texture>. More tests for other things can be found online.

### Understanding from these tests

Soil test results can be used to appreciate soils. This article has only been looking at the topsoil – which is created from what is below, within and above. Use the results to consider their origins: rock underneath, compost and living things within, mulch and living things upon, and climate.

Soil test results can be used to improve the health of soils. Most people live in urban areas with soils that are now typically "Anthropomorphic" meaning that the topsoil is man-made. Housing construction destroys topsoil. Bits of building materials may be left to find their way into soil along with any 'new soil' brought from elsewhere for landscaping. Gardeners buy potting mix to start gardens. What will live best here? Tests help identify this soil's nature and health. Plants can then be chosen to fit this, and/or decisions made on how to change the soil so that healthy plants can grow!

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