



What soil type?

Assessing the level of water and nitrogen available to grow a crop depends on selecting the right soil information. This relies on experience and knowledge of the local area and on being able to describe the physical properties of the particular soil type.

Three aids to this have been included:

1. *Determining soil texture* describes how to define the texture of the soil.
2. *Identifying the soils of the Condamine Floodplain* is a key to identification of the major soils of the Darling Downs associated with the Condamine River. Identification is based on soil texture, structure, colour and associated native vegetation.

3. *Soil Map of the Central Downs* identifies the major soil groupings for the Darling Downs. Overlaid on these major groups is the location of each of the characterisation sites (for the Darling Downs) referred to in this module. This enables identification of the soil type and location of the nearest appropriate characterisation site. The map is published by the Queensland Department of Natural Resources.

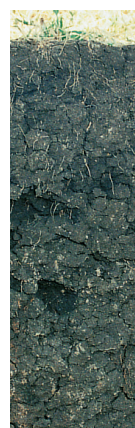
If your area is not covered by the key or map, you should contact local consultants, DPI, DNR or Agriculture Department staff to help you with soil identification.

APSoil

APSoil is a computer program which allows you to input the analytical results received from the lab and to select soil characterisation information for a particular soil type (based on the information in this module). APSoil then calculates the quantity of water and

nitrogen available to a particular crop. The results can be presented as graphs or tables.

An example of APSoil output is given in Module 1 (p.5). APSoil software can be downloaded at:
<http://www.farmscape.tag.csiro.au>



Soil matters

1. Determining soil texture

(adapted from Soil Check, Forge, 1995)

Texture is a measure of the relative proportions of sand, silt and clay in the soil. It can be estimated from observing the changes in a small handful of soil when moistened with water, worked into a ball and pressed between your thumb and forefinger. Topsoil and subsoil textures are always determined separately.

The soil's texture can tell a lot about how the soil interacts with plants in an agricultural system. Texture is important because it affects movement, retention and availability of water and nutrients in the soil, and the soil's behaviour when cultivated.

Texture also affects other aspects of the soil, such as structural behaviour and susceptibility to erosion. The clay component is very important because it holds most of the water and nutrients. On the other hand, soils with a high clay content can have drainage problems. Structure (the arrangement of particles in peds and larger aggregations) also influences drainage.

You will need:

- rainwater or clean water
- soil samples
- a sieve (if there is gravel in the soil).

Five easy steps to soil texture

Note: if a soil corer has been used, look over the length of the core first. Generally, sandy and loamy soil breaks up easily, while a layer that is high in clay will be highly cohesive.

Repeat the following steps on each part of the soil to be tested.

1. Take enough soil to fit into the palm of your hand. Remove any large stones, twigs or stubble.
2. Moisten the soil with water, a little at a time, and knead until the ball of soil just fails to stick to your fingers. Add more water to get it to this *sticky* point (this is the soil's Drained Upper Limit).
3. Work the soil in this manner for one to two minutes, noting its behaviour (See Table 5.1). Inspect the sample to see if sand is visible. If not, it may still be felt or heard as the sample is working.

A soil with a high proportion of:

- sand – will feel gritty
- silt – will feel silky
- clay – will feel sticky

4. Press and slide the ball out between thumb and forefinger to form a ribbon. Note the length of self-supporting ribbon that can be formed.

5. Use Table 5.1 to classify the soil.

Remember that soil texture can change as you go down the soil profile and this variation is described by the following terms:

- *Uniform* – the texture is the same throughout the profile.
- *Duplex* – the texture changes significantly at a certain depth; there is often about 150 mm of loam over a dense clay subsoil. (These are also called texture-contrast soils.)
- *Gradational* – the texture changes gradually down the profile. Many soils vary from a loamy surface to a clay loam and then to clay.

(adapted from Chapman and Murphy, 1991)



Table 5.1. How to determine soil texture

Ball	Ribbon (cm)	Feel	Texture
Will not form a ball	0.5	single grains of sand stick to fingers	sand (S)
Ball just holds together	1.3-2.5	feels very sandy, visible sand grains	loamy sand (LS)
Ball holds together	1.3-2.5	fine sand can be felt	fine sandy loam (FSL)
Ball holds together	2.5	spongy, smooth, not gritty or silky	loam (L)
Ball holds together	2.5	slightly spongy, fine sand can be felt	loamy fine sand (LFS)
Ball holds together	2.5	very smooth to silky	silt loam (SL)
Ball holds together strongly	2.5-4	sandy to touch, medium sand grains visible	sandy clay loam (SCL)
Ball holds together	4-5	plastic, smooth to manipulate	clay loam (CL)
Ball holds together strongly	5-7.5	plastic, smooth, slight resistance to shearing between thumb and forefinger	light clay (LC)
Ball holds together strongly	>7.5	plastic, smooth, handles like Plasticine, can be moulded into rods without fracture, moderate shearing resistance	medium clay (ML)
Ball holds together strongly	>7.5	plastic and smooth, handles like stiff Plasticine, can be moulded into rods without fracture, very firm shearing resistance	heavy clay (HC)



Soil matters

2. Identifying the soils of the Condamine Floodplain

This key will help in identification of soils on the Condamine floodplain.

It should be used in conjunction with the section on determining soil texture

(Table 5.1) and with Table 5.2 which provides information on some of the characteristics of the major soils of the Darling Downs.

Key to the soils of the Condamine Floodplain

1. Soil profile is a uniform clay texture throughout	2
1. Soil profile exhibits a texture contrast (between the surface and the subsoil)	3
2. Soil surface is very fine (powdery), and soil depth is <1.0 m	4
2. Soil surface is fine to coarse, and soil depth is >1.0 m	5
3. Soil profile is red-brown or red in colour	6
3. Soil profile is predominantly brown or black in colour	7
4. Subsoil is dominated by hard calcareous material (and within 50 cm of the surface)	<i>Edgecombe</i>
4. Subsoil is dominated by >50% soft calcareous material (and within 50 cm of the surface)	<i>Yargullen</i>
5. Soil surface exhibits moderate to severe cracking	8
5. Soil surface exhibits minor cracking, subsoil brown LC-MC*	<i>Anchorfield</i>
6. Soil surface texture is FSL to FSCL, A horizon is <30cm deep, hard-setting, vegetation is poplar box	<i>Oakey</i>
6. Soil surface texture is <FSL, A horizon is >30cm deep, crusting to hard-setting	<i>Formartin</i>
7. Subsoil is black (dark), surface hard-setting	<i>Haslemere</i>
7. Subsoil is brown, surface hard-setting	<i>Dalmeny</i>
8. Soil surface is grey, with visible fine sand, often crusting/hard-setting texture LC, vegetation is poplar box	<i>Cecilvale</i>
8. Soil surface is self-mulching	9
9. Sand (usually coarse) visible throughout the profile, found in close proximity to major streams, commonly flooded, usually growing river red gum	<i>Condamine</i>
9. Little or no sand visible in the profile	10
10. Surface structure coarse	<i>Mywybilla</i>
10. Surface structure fine to moderate	11
11. Surface structure is fine	12
11. Surface structure moderate, found in depressions amongst Waco	<i>Waverly</i>
12. High phosphorus levels	<i>Waco</i>
12. Occurs between <i>Waco</i> and <i>Mywybilla</i> , low phosphorus levels	<i>Norillee</i>

Soil texture abbreviations are detailed in Table 5.1.

(Information from A. Biggs, DNR, Toowoomba)

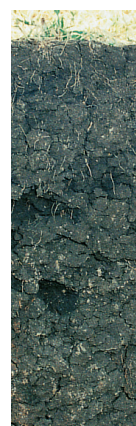


Module 5. Soil characterisation data

Table 5.2. Characteristics of Darling Downs soils

Soil name	Waco	Cecilvale	Anchorfield
Origin	Basaltic, alluvium, on active, low gradient fans	Alluvial fan derived from Walloon sandstone & basalt	Condamine River alluvium, basaltic source
Great soil group	Black Earth Ug5.15	Grey clay Ug5.4	Black Earth Ug5.15
Natural vegetation	Plain dominated by <i>Themeda</i> and medics	Poplar Box	Broad low banks on plain
Colour	Surface - very dark brown (10yr 2/2 - 7.5yr 2/2) At depth - dark brown (at 1.5 m, 10yr 2/3, at 1.8m, 7.5yr 4/3)	Surface - grey (not brown)(10yr 3/1) At depth - yellow/ olive (2.5yr 4/2, 5/3)	Surface - very dark brown (10yr 2/2-7.5yr 2/2) At depth - brown and yellow/ brown (7.5 yr 3/3 - 4/2, 10yr 5/4)
Clay %	70-75	35-50	50 at surface 32 at depth
Structure/ cracking	Structure - very fine surface tilth; no sand in surface, aggregates break down to microscopic level on slickensides good emergence Cracking - severe, related to clay % and type (smectite clay prone to cracking)	Structure - coarse surface; sandy particularly after rain, prone to crusting/ slaking; poor emergence Cracking - moderate	Structure - coarser than Waco but finer than Condamine; quartz sand at surface; sub-soil very fine sand in sedimentary layers (no structure) Cracking - minor
Phosphorus (mg/kg) (soil in natural state)	Total 1000-2000 BSES* 800-1400	Total 200-300 BSES* 7-10	Total 1700 BSES* 900-1400
Calcium carbonate	Diffuse with nodules (through profile)+ soft areas at depth (surface effervesces with H ₂ SO ₄ or HCl)	nodules at depth	nodules at depth
Comments	very soft soil easy to push spade into full depth Boron may be deficient	Sandy hard setting surface, prone to crusting	Subdued gilgai, small mounds 1-2m across, <5cm above general level

*BSES – extraction with dilute H₂SO₄



Soil matters

Soil name	Norillee	Mywybilla	Condamine	Irving
Origin	Alluvium origin, is either distal end of Waco fan or older fan; of similar age to C/vale but from different parent material (more sandstone)	Condamine River alluvium, same age as Cecilvale	Condamine River alluvium (mixed origin), present flood plain	Basaltic, colluvium
Great soil group	Black Earth Ug5.16	Black Earth Ug5.16	Black Earth Ug5.15 or 5.16	Black Earth Ug5.15
Natural vegetation	Open grass plain	Open grass plain, no medics in natural state	Blue gum woodland	Woodland
Colour	Surface - greyer than Waco, similar to cultivated C/vale (10yr 3/1) At depth - not as brown as Waco, olive/brown (2.5yr 3/2) to light brownish grey (10yr 5/1), some yellowish mottle	Surface - greyer than Norillee (10yr 3/1) At depth - olive/brown (2.5yr 3/2 to 10yr 5/1) usually with faint yellowish mottle	Surface - very dark grey brown (10yr 2.5/1.5) At depth - dark grey/brown (10yr 3.5/2)	Surface - 10yr 2/2-3 to 7.5yr 2/2, 2/3 At depth - reddish brown (5yr 4/3)
Clay %	65-70	60-70	58-80	68-70
Structure/ cracking	Structure - physically similar to Waco (fine surface structure), no sand in surface; chemically similar to Mywybilla (related to it) Cracking - severe	Structure - tight, coarse, blocky structure (hard to break apart), abrasive, some sand in surface; poor emergence Cracking - severe	Structure - medium to coarse, tight, blocky, sand through profile Cracking - severe	Structure - fine to medium Cracking - moderate
Phosphorus (mg/kg) (soil in natural state)	Total <400 BSES* 70-90	Total low, <400 BSES* 5-20	Total 800-1600 BSES* 340-700	Total 1000-1400 BSES* 500-700
Calcium carbonate	diffused with nodules through profile (surface effervesces with H ₂ SO ₄ or HCl)	nodule form only, to within 10cm of surface in mounds	nodules at depth	nodules at depth
Comments	high salt level at depth (> 1m) may affect water uptake; fine surface tilth may be due to high % of diffuse Ca	hard to wet up but good water holding, harsh feel of cultivated aggregates, lumpy surface appearance after rain as large aggregates resist break down	Quartz grain sand evident in surface	Linear gilgai

Soil information from C. Thompson, CSIRO

Soil characterisation data

Data that characterise the soils of the northern cropping region are detailed in a separate booklet provided in the manual folder.

Updated versions of the booklet will be available periodically from APSRU or may be downloaded from the Internet at:

<http://www.farmscape.tag.csiro.au/>
or by contacting the author.

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