KNOWING YOUR SOILS

SOUTH AUSTRALIA

UTE GUIDE

A simple tool for managing your soils

LANDSCAPE SOUTH AUSTRALIA

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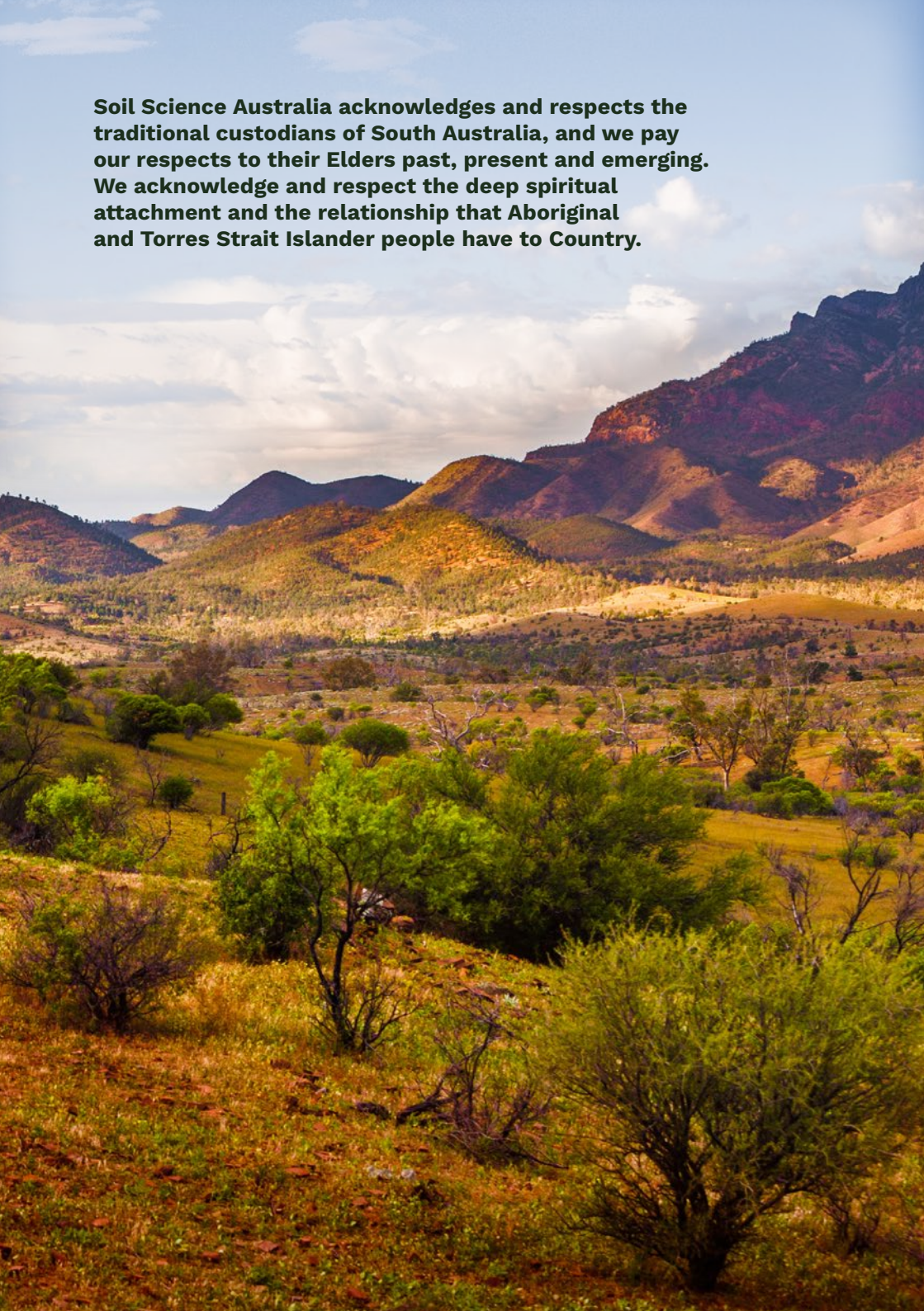
Australian Government

Soil Science Australia acknowledges and respects the traditional custodians of South Australia, and we pay our respects to their Elders past, present and emerging. We acknowledge and respect the deep spiritual attachment and the relationship that Aboriginal and Torres Strait Islander people have to Country.



Contents

Why should I do the soil tests in this guide?

Understanding your soils will help you to improve the soil health, profitability and sustainability of your farm. The ongoing record of your soil testing will help you to identify soil constraints and track improvements as you implement different management practices.

State soil maps can help you understand the soil variability on your property. Contact your local Landscape Board for soil maps for your region.

Knowing your soils South Australia (SA) is the companion reference handbook to this ute guide. It provides additional background information about soils, soil constraints, and management strategies for your soils. There is a reference to the relevant information in the *Knowing your soils SA handbook* under each test.

How to choose your sites and when to sample

A property map (digital or hand drawn) will help you to choose your sampling sites. You can choose one sampling site per paddock to give you an overview of the soils on your property. Alternatively, you use several sampling sites in one paddock that will indicate variability in soil condition within that paddock.

It is recommended that you perform the tests at least once a year in autumn. Conduct the tests at the same time each year, and at approximately the same time of day. If possible, increase your testing to twice a year (autumn and spring). As you become more familiar with the test procedures and your soils, you can choose the sampling sites and tests that best meet your needs.

Soil testing procedure

There are 3 cards to fill out as part of the soil testing procedure – *Soil description card, Soil test results card* and *Scorecard*. These 3 cards give you a simple record of your soil health that you can refer to later. It is recommended that you fill out the cards using pencil or erasable pen so the card be reused each time you test your soil. Photograph the card after use so you have a record of results and any potential problems or improvements in your soil. Step-by-step instructions for each soil test are outlined in the ute guide from page 13.

Soil testing steps

1. Read this guide to get an overview of the tests, and how and why they are used.

2. Gather or make the equipment you need using the soil equipment checklist (page 4). Keep the kit in a box where you can readily find it next time you need it.

3. Decide where your sampling sites will be and mark the sampling sites on a copy of your property map.

4. Record date and weather conditions on the *Soil description card* (page 5).

5. At each site:

   a) record site details on the *Soil description card*.

   b) bury cotton strips or 'undies' for the soil microbial test. You will collect these 8 weeks later and record the results on the *Scorecard* (page 7).

   c) conduct the other 10 soil tests in the order listed below. Record the results for most of the tests in the *Soil test results card* (page 6). Add the soil texture test results to the *Soil description card* because you only need to do this test once.

   After 2 months, return to the burial sites for the soil microbial test (Soil Your Undies) and dig up the cotton items. Record the state of decomposition on the *Scorecard*.

6. Total the results of the *scorecard* for each site. Check for *Possible causes for low test scores* (page 9 and use the *When to seek help flowchart* (page 11) to decide if you need soil specialist support.

The aim of soil testing is to improve the site score every year by managing soil constraints, improving groundcover, managing weeds and increasing soil organic matter. For more detailed information about improving your soil, refer to the *Knowing your soils SA* companion reference handbook.

SOIL TESTING

Equipment kit checklist

- [ ] Soil description card (one copy per 5 sampling sites)
- [ ] Pen and permanent marker
- [ ] Smartphone with timer and camera (or timer and digital camera)
- [ ] Bucket
- [ ] Rags or paper towels for cleaning up
- [ ] 5 L of tap water for infiltration test
- [ ] Spray bottle or water bottle with rainwater or distilled water (it is important to use rainwater or distilled water for the slaking and dispersion test)
- [ ] Square spade or shovel
- [ ] Trowel or knife
- [ ] Secateurs or shears
- [ ] Stakes and marker flags for each sampling site
- [ ] 5 strips of white 100% cotton or 2 pairs of white 100% cotton undies and 5 ziplock plastic bags
- [ ] Hand-made 30 cm by 30 cm quadrat (square frame) from wire or cardboard for ground and weed cover % estimation
- [ ] Soil pH test kit from a hardware store or garden centre
- [ ] 2 flat bottom dishes or jars for the dispersion and slaking test
- [ ] White tray or board
- [ ] Magnifying glass or hand lens
- [ ] Ruler or tape measure
- [ ] 2 mm sieve (optional)
- [ ] Mortar and pestle (optional)
- [ ] Hand-made infiltrometer tube (see picture on right)
- [ ] Hardwood board and mallet for banging the tube into the ground

Making your infiltrometer and quadrat

Cut 9 cm length of poly pipe (a diameter of 9 cm is ideal). Cut plastic ruler to the 0 cm and the 7 cm mark and glue to the inside of polypipe with 0 mark at the top.

** You can also mark centimeter increments on the inside of the polypipe if you do not have a ruler.*

Homemade quadrat

Soil description card

Date:	Weather conditions (wet, dry, drought, prolonged wet):

Site description

Sampling site	Site 1	Site 2	Site 3	Site 4	Site 5
Time of day					
Sampling site location/GPS coordinates					
Landform (e.g. slope, hill, flat, boggy)					
Soil type (ask your Landscape Board)					
Current land use (pasture, cropping, forestry, native vegetation)					
Previous land use					
Soil moisture (dry, moist, waterlogged)					
Soil texture (topsoil – 5 cm) (only do once)					
Soil texture (subsoil – 20 cm) (only do once)					

Soil test results card

Date:

Test	What to record	Site 1	Site 2	Site 3	Site 4	Site 5
Ground cover percentage	Choose from 20%, 40 %, 50%, 80 %, 90%, 100%. Take a photo.					
Weed cover percentage	Choose from 20%, 40 %, 50%, 80 %, 90%, 100%. Take a photo.					
Leaf colour	Any noticeable plant leaf discolouration					
No. of soil organism types present	The number of soil organisms and time of day.					
No. of earthworms present	The number of earthworms and time of day					
Soil compaction	The depth of compaction layer in cm					
Topsoil pH (5 cm)	Test kit pH using colour wheel					
Subsoil pH (20 cm)	Test kit pH using colour wheel					
Water infiltration (infiltration rate in mm/hr)	Infiltration rate in mm/hr					

Scorecard

Test	Poor rating (= 1 point)	Fair rating (= 2 points)	Good rating (= 3 points)	Site 1	Site 2	Site 3	Site 4	Site 5
Ground cover percentage	Less than 50% average ground cover (ground plants or mulch)	50% to 75% average ground cover (ground plants or mulch)	More than 75% average ground cover (ground plants or mulch)					
Weed cover percentage	More than 75% weeds	50% to 75% weeds	Less than 50% weeds					
Leaf colour	Stunted plants, leaf discolouration	Some variation in growth and colour	Appropriate leaf colour and uniform plant growth					
Soil organism type count	Fewer than 2 types of soil organisms visible	2 to 5 types of soil organisms visible	More than 5 types of soil organisms visible					
Earthworm count	0 to 3 earthworms present	4 to 6 earthworms present	More than 6 earthworms present					
Root development	Roots are shallow and sparse	Moderate root growth	Deep, extensive root system. Lots of fine roots					
Water repellence	More than 60 seconds for water drop to disappear	10 to 60 seconds for water drop to disappear	1 to 10 seconds for water drop to disappear					
Topsoil colour	Pale or grey, indicating low organic matter	Moderately dark colour	Dark, rich colour indicating high organic matter					
Soil compaction	Thick compaction layer, no root growth	Thin compaction layer, some roots can grow through the layer	No layers of compaction, roots grow freely					

Topsoil pH	Strongly acidic or alkaline (below 5.5 or above 8.0)	Moderately acidic (5.5 to 6.0) or alkaline (7.5 to 8.0)	Near neutral (6.0 to 7.5)					
Subsoil pH	Strongly acidic or alkaline	Moderately acidic or alkaline	Near neutral					
Soil slaking at 5 cm depth (refer to page xx for images)	Aggregate broke apart in less than one minute	Aggregates remained partially intact after 10 minutes	Aggregates remained mostly intact after 10 minutes					
Soil dispersion at 5 cm depth after 20 mins	Obvious milkiness	Faint milkiness	No milkiness					
Soil dispersion at 20 cm depth after 20 mins	Obvious milkiness	Faint milkiness	No milkiness					
Water infiltration (infiltration rate in mm/hr)	0 to 30	31 to 100	Greater than 100					
			Total	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**

Soil microbial test (Soil Your Undies) rating

Score	Site 1	Site 2	Site 3	Site 4	Site 5
How decomposed is the cotton fabric after 8 weeks? Not decomposed at all (= 1 point); Partially decomposed (= 2 points); Very decomposed (= 3 points)					

Adapted from New South Wales Department of Primary Industries, Northern Rivers Health Card, https://www.soilcare.org/uploads/2/9/1/9/29197227/original-nr-soil-health-card.pdf and NQ Dry Tropics, Rapid Assessment of Soil Health (RASH) manual, https://cdn.environment.sa.gov.au/landscape/docs/ep/rapid_assessment_of_soil_health_rash_manual.pdf

Possible causes for low test scores

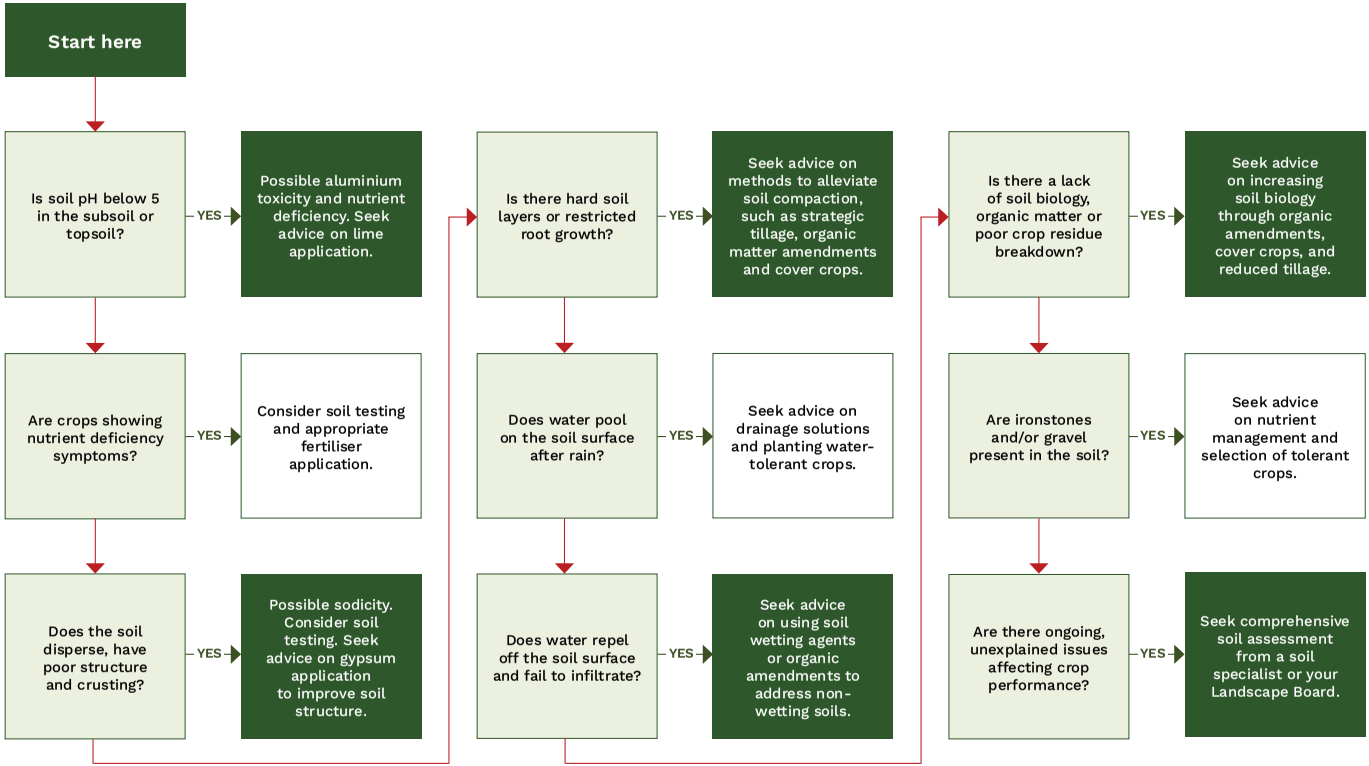
This table provides a summary of the indicators and possible causes for low test results.

Test Result	Situation indicator	Possible causes
Poor soil structure	Powdery soil, few crumbs, excessive clods	Lack of soil-binding substances, low organic matter, few worms, topsoil loss, soil compaction, excessive cultivation, 'puddling' of wet soil by stock
Poor root development	Hard soil lacking spaces, poor plant nutrition, root disease or attack	Loss of topsoil, poor soil structure, soil compaction; unsuitable soil pH, lack of nutrients, soil-borne pathogens, root-feeding nematodes or insects
Soil moisture	Very dry or waterlogged	Soil type, compaction, rising water table, climatic conditions.
Low soil biology	Lack of habitat or food for organisms, poor soil structure, presence of harmful chemicals, little organic matter	Sparse litter, low soil organic matter, lack of soil spaces and channels, low or high pH (pH less than 5 and pH above 8), excessive tillage, mortality from insecticides or cumulative chemicals (e.g. copper)
Low pH	High level of acidity, poor crop and root growth	Excess nitrogen from fertilisers or legumes, poor drainage, low organic matter, shallow topsoil, unused nitrogen
Slow water infiltration	High proportion of clay particles, lack of spaces, channels, or burrows in soil	Naturally high clay content, loss of topsoil, soil compaction, poor soil structure, lack of earthworms, surface crusting
Water repellence	Water forms a spherical shape on the surface and does not soak into the soil	Water repellence is formed from the production of hydrophobic organic compounds during the decomposition of organic matter. Water repellence is common in sandy soils which a low surface area that can be easily coated

Compaction	Soil is generally hard, hard at the surface only, or a hard layer at depth	Compacted by vehicles and equipment, soil type, livestock or overworking the soil, low organic matter content, wet soil, heavy vehicles, 'hard pan' from soil inverting cultivators
High slaking	Soil particles slake (fall apart) when wet	Topsoil loss, compaction, low organic matter, excess tillage; few soil organisms to mix the soil, acid conditions, sodic soil
High dispersion	Soil particles disperse when wet	Excess sodium build-up in the soil due to climatic conditions, rising groundwater and water tables, high salt irrigation water
Poor leaf colour	Plants discoloured	Soil constraints, nutrient deficiencies (confirm via soil or leaf analysis), low organic matter, disease, waterlogging, pH
Low ground cover	Ground plants absent or growth is poor	Unsuitable plant type(s), soil compaction, erosion, shading, trampling (especially when wet), overstocking, over cultivating soil

Adapted from New South Wales Department of Primary Industries, Northern Rivers Health Card, https://www.soilcare.org/uploads/2/9/1/9/29197227/original-nr-soil-health-card.pdf

When to seek help



STEP-BY-STEP INSTRUCTIONS FOR SOIL TESTING

Soil microbial test (Soil Your Undies)

Healthy, biologically active soils, rich in microorganisms such as bacteria and fungi, will decompose the cotton fabric more rapidly and completely. Conversely, poor soil health with low microbial activity will result in minimal decomposition. This test provides a simple way for farmers to visualise the presence of soil microorganisms in organic matter breakdown and nutrient cycling. It is best done in spring when there is more soil moisture.

1. At each sampling site, dig a hole 5 cm deep and large enough to lay the strip of cotton flat or a pair of cotton undies in the soil. Leave a tag of cotton out so that you can find the strip again. Lay the cotton strips or undies in the hole and replace the topsoil to bury them.

   Alternatively, if you are using a cotton strip, you can push the spade vertically down into the soil to make a slot in the soil. Fold one end of the cotton strip over the bottom end of the spade and push the cotton strip into the soil so that it sits vertically through the soil profile. Push the soil back so that the cotton is in contact with the soil on both sides.

2. Mark the site with a stake and a flag.

3. Leave the cotton strips or undies buried for 8 weeks. Mark the date in your calendar to remind you to check.

4. At the end of 8 weeks, carefully dig up the cotton strips or undies. Photograph (or video) the soiled cotton. Has most of the cotton fabric in the undies disappeared or is it mostly still intact? Assign a rating for the level of decomposition on the *Scorecard* for that sampling site. You can use the following photos as a guide to decomposition. Very decomposed (= 3 points) would mean there would only be the elastic bands of the undies, or very little of the cotton strip remaining.

Not decomposed at all (= 1 point)

Partially decomposed (= 2 points)

Ground cover and weed cover percentage

Soils become more susceptible to wind and water erosion when there is no protective vegetative soil cover, particularly during dry periods. Valuable topsoil can be lost, leading to long-term decreases in productivity, soil structure and soil biology. Invasion of weeds is also common when ground cover is not maintained. Looking at your groundcover and weed cover is an important step of soil management. Over time, aim to decrease weed cover and maintain or increase groundcover. For more information see *Knowing your soils SA handbook: Maintaining ground cover*, page 54.

1. At the sampling site, place your home-made quadrat and the following pictures to estimate the proportion of ground cover (ground plants, stubble or mulch).
2. Record the ground cover percentage on the *Soil test results card* and use the *Scorecard* to rate whether the ground cover is poor, fair or good.
3. Similarly, record the weed cover percentage on the *Soil test results card* and use the *Scorecard* to rate whether the weed cover is poor, fair or good.
4. Take photos to record the ground cover condition and the weeds present. Note where the photos were taken and the date of the photos.

20% ground cover

40% ground cover

50% ground cover

80% ground cover

90% ground cover

100% ground cover

Leaf colour

The leaf colour of your pasture plants, crops or trees may indicate problems e.g. lack of nutrients, soil compaction or waterlogging. The following pictures are examples of varying leaf colour (Image 1) and discolouration (Image 2).

1. Check the colour of the growing leaves and plant growth condition and record any discolouration on the *Soil test results card*.
2. Use the *Scorecard* to rate whether the leaf colour is poor, fair or good.
3. Add the rating number to the *Site score* box for this sampling site.

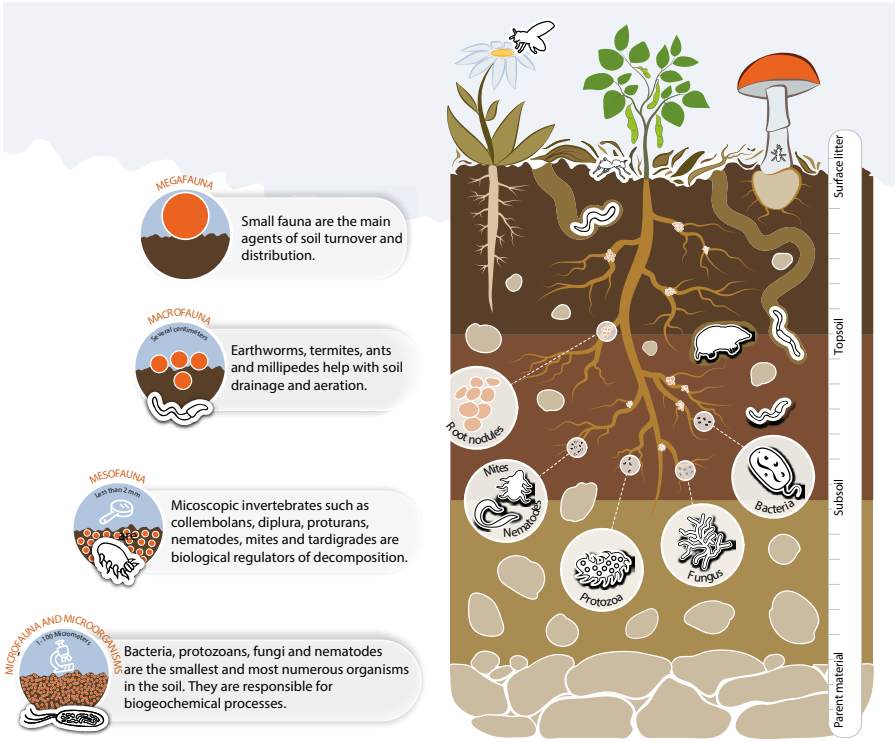
Image 1: Varying leaf colour on faba beans indicating possible soil acidity.

Image 2: Discolouration on wheat indicating possible nutrient deficiencies.

Soil organism type and earthworm count

A healthy soil biota can increase nutrient cycling, regulate plant nutrient supply and loss, decompose plant residues and improve soil structure. Low soil organic matter, lack of soil spaces and channels from compaction, low or high pH (below pH 5 or above pH 8), excessive tillage, insecticides or cumulative chemicals such as copper can all affect soil biology. Retaining organic matter, minimising tillage and maximising groundcover, managing soil constraints and planting a diverse range of crops and pasture species can all help improve soil organism counts. For more information see *Knowing your soils SA handbook: Soil biology*, page 48.

1. Record the time of day on the *Soil test results card* because the time of day can affect the count.
2. Use a square spade or shovel to dig out a clump of soil approximately 10 cm deep and 15 cm square. You may need to trim the vegetation close to ground level.
3. Place it on the ground and carefully lift off the top 5 cm layer of the sample with your hands. Place it on a white tray or board.
4. Gently spread the sample out thinly with a spoon or a stick, leaving bare spaces between the soil.
5. Look at the sample. Allow a minute for your eyes to adjust to staring at this scale.
6. Set a timer for 5 minutes. Observe the different types of organisms and earthworms in the sample by eye or with a magnifying glass or hand lens. Gently move the soil to find the soil organisms or earthworms. The organisms could include earthworms, mites, spiders, ants, beetles, millipedes, centipedes, pillbugs, slaters or insect larvae. Count the number of different types of soil organisms that you find in 5 minutes. You don't need to be able to identify each type of organism. You just need to recognise that it is different from the other types of organisms in the sample.
7. Record the soil organism type count on the *Soil test results card* and use the *Scorecard* to rate whether the count result is poor, fair or good.
8. Similarly, record the earthworm count on the *Soil test results card* and use the *Scorecard* to rate whether the count result is poor, fair or good.



*Adapted from Food and Agriculture Organization of the United Nations 'Soils Biodiversity: the world beneath our feet' (2019)***

Root development

Healthy root development indicates you have good soil structure, and the soil constraints like soil acidity, soil compaction or soil sodicity are minimal. Good root development further helps with soil structure, erosion prevention, weed suppression, increasing soil biology and soil organic matter and nutrient recycling. You can improve your root development by managing your soil constraints. For more information see *Knowing your soils SA handbook: Living roots and cover crops*, page 58 and *Soil constraints*, page 63.

1. Using the clump you dug out for the *Soil organism type* count, shake out the plant roots in the clump to assess their root development. Add your observations about root development to the *Soil test results*.
2. Use the *Scorecard* to rate whether the root development is poor, fair or good.
3. Add the rating number to the *Site score* box for this sampling site.

Photo: Cassandra Douglas Hill

Water repellence and non-wetting soils

Water repellent and non-wetting soils pose several challenges, primarily affecting crop establishment and growth. Poor water infiltration leads to uneven soil moisture distribution, resulting in patchy germination and inadequate root development and the growth of weeds. Non-wetting soils can be managed using mechanical, chemical and biological strategies (or a combination of these), to improve water infiltration and soil structure. For more information see *Knowing your soils SA handbook: Non-wetting soils*, page 88.

1. At the sampling site, drop rainwater or distilled water onto the soil surface. If the drop disappears, water repellence is not a problem.
2. If the water drop takes on a spherical shape on the soil surface, water repellence is likely. Set up a timing device (e.g. smartphone or watch). Record how long, in seconds, it takes for a drop to disappear (up to 120 seconds).
3. Record how long it takes (in seconds) for a drop to disappear on the *Soil test results card* and use the *Scorecard* to rate whether the water repellence result is poor, fair or good.

Photo: Edward Scott

Topsoil colour

Black/dark brown soil usually indicates the presence of decaying organic matter. Pale grey, brown/yellow soil can indicate that levels of organic matter are low and there is low fertility and poor structure.

1. At the sampling site, deepen the hole you made for *Soil organism type count* by digging out more soil to spade depth (about 30 cm). Scrape one side of the hole to show the soil profile.

2. Use the use the *Scorecard* to rate whether the topsoil colour is poor, fair or good.

Soil compaction

A compacted soil is a denser section or layer of soil within the soil profile. Scan the side of your testing hole to find any layers of compacted or tight soil. The effort needed to dig the hole will give you some indication, but you can also push a penknife into the side of the hole at various depths to check for compaction. Soil compaction leads to poor crop or pasture establishment, slow root growth, reduced water infiltration, reduced biological activity and reduced crop yields. It also leads to rough seedbeds, poor crop establishment, slow root growth, reduced water infiltration, reduced biological activity and reduced crop yields. For more information see *Knowing your soils SA handbook: Soil compaction and soil structural stability*, page 64.

1. Using the 30 cm deep hole at the sampling site, scan the side of the hole to find any layers of compacted or tight soil. You will probably identify any compacted layers while digging the hole. However, you can also push a penknife into the side of the hole at various depths to check for compaction.

2. If you find a compacted layer, record its depth and observations about root growth on the *Soil test results card* and use the *Scorecard* to rate whether the soil compaction is poor, fair or good.

Photo: Edward Scott

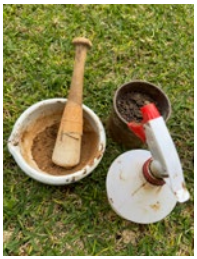
Soil texture – ribbon test

Soil texture summarises the particle size distribution in a soil i.e. the amount of sand, silt and clay proportions in a soil. It is important to understand the soil texture as almost all soil properties and functions are influenced by the particle size and the space between the particles (the pores). For more information see *Knowing your soils SA handbook: Soil texture*, page 7.

1. Using the 30 cm deep hole at the sampling site, take a small handful of soil from the 5 cm depth layer (topsoil).
2. If you can, sieve the sample using a 2 mm sieve to remove gravel and stones, and to break up clumps of soil. You can also use a mortar and pestle to break up the lumps.
3. Place a small handful of crushed soil in your palm. Use a water spray bottle to dampen the soil. Work the soil in your hand while applying the water. You are trying to form a ball of soil which can be moulded but is not wet. If the sample gets too wet, add more dry soil from the same layer.
4. Look at how your soil is holding together and how it feels. Some won't stick together (sands), some are like plasticine (clays) and some feel spongy (loams). Use the questions in the *Soil texture flowchart* below to identify the soil texture for the 5 cm depth soil layer at this site.
5. Record the soil texture type (topsoil – 5 cm) on the *Site description card*.
6. Repeat steps 1 to 5, taking a 20 cm depth subsoil sample from the same hole.
7. Record the soil texture type (subsoil – 20 cm) on the *Site description card*.

Remember that you only need to do this test once at each sampling site. The soil texture doesn't change over time.

Hand texturing a soil

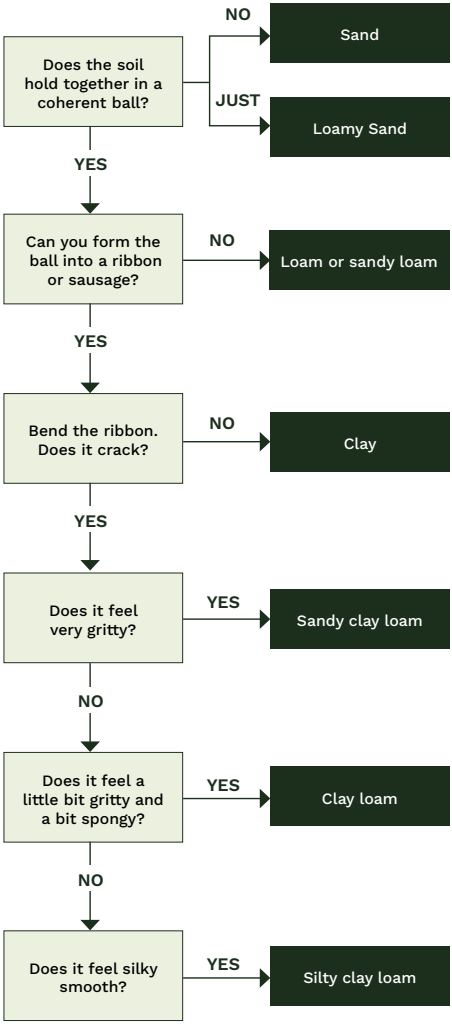



Assemble equipment. You may need a mortar and pestle to crush the soil. Remove any roots or gravel. Pour out some soil into your hand.


Wet up the soil with a spray bottle gradually.


Bring the soil into a ball (bolus) with your hand. You may need to add more dry soil, then more water gradually until the soil comes together. Assess the ball for coherance and begin the flow chart to the right.


Try to roll a sausage with the soil ball. Bend the sausage, assess for cracks, feel if the soil is spongy, gritty, smooth and/or silky. Determine your texture via the flow chart.



Soil pH test – topsoil and subsoil

Soil pH measures the soil acidity or alkalinity. Acid soils have a low pH (pH 2 to 5.5), while alkaline soils have a high pH (pH 8 to 10). Soil acidity can also be affected by agricultural practices such as removing produce or adding fertilisers (especially nitrogen or sulfur). Alkalinity is usually an inherent characteristic of soils, although it can be increased by irrigating with alkaline or saline water. Most agricultural plants prefer near neutral (5.5-8.0) pH levels. Excessively acidic or alkaline soils are often less productive. Managing acidic soils with lime is particularly important for productivity.
For more information see *Knowing your soils SA handbook: Soil acidity*, page 82.

1. Using the 30 cm deep hole at the sampling site, take a small sample of soil from the 5 cm depth topsoil layer. Place it on the white card provided in the pH test kit. Remove any rocks or organic matter like twigs, leaves or organic matter.
2. Squirt some of the indicator dye on the sample and mix well with the paddle provided. The soil sample should be damp but not wet.
3. Dust the sample with the barium sulfate (white) powder in the kit and do not mix. Wait for the colour of the powder to change.
4. Compare the colour of the sample with the colour chart provided in the kit to determine the pH of the soil.
5. Record the pH on the *Soil test results card* and use the *Scorecard* to rate whether the topsoil pH is poor, fair or good.
6. Take another sample of soil from the 20 cm depth subsoil layer, repeat steps 1 to 4. Record the subsoil pH on the *Soil test results card* and use the *Scorecard* to rate whether the result is poor, fair or good.

Using a pH test kit in the field

The pH kit and soil sample

Place soil onto the tray provided

Add pH dye indicator

Mix pH dye with soil

Dust on barium sulfate powder.
Do not mix.

Observe colour change

Use colour wheel to match colour and determine pH of soil sample.

High pH (alkaline) = Purple colour
Neutral pH = Green colour
Low pH (acidic) = Yellow/orange colour

Soil slaking (topsoil) and dispersion (topsoil and subsoil)

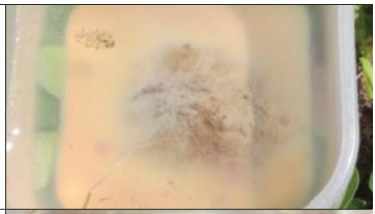
When you are looking at slaking or dispersion, you are testing for soil stability. Slaking is the breakdown of a clump of soil into smaller fragments when it is wet. Put clumps of soil (aggregates) from the topsoil (5 cm) and subsoil (20 cm) into a dish. Add water to watch how the soil aggregates change when wet. Slaking is often more severe in soils with low organic matter. If you leave the aggregates to sit for longer than 20 minutes, you might see a milkiness in the water. This indicates dispersion. It caused by excess sodium in the soil (sodicity) and may require the application of gypsum. Dispersive soils can cause gully erosion and surface crusting, and reduced root development and seedling growth. For more information see *Knowing your soils SA handbook: Soil structural stability*, page 66.

1. Collect some soil aggregates or clumps (about 10 to 20 mm in diameter) from the 5 cm depth (topsoil) and place in a dish. Collect some soil aggregates or clumps (about 10 to 20 mm in diameter) from the 20 cm depth (subsoil) and place in another dish. You will use these samples to test for slaking at the 5 cm depth and for dispersion at both 5 cm and 20 cm depths.
2. Add enough distilled water or rainwater to each dish to cover the aggregates.
3. Watch the aggregates from both the 5 cm and 20 cm depths for a few minutes to observe if slaking occurs i.e. the soil aggregates 'fall apart'. Note if the aggregates break apart in less than one minute. Otherwise, check the condition of the aggregates after 10 minutes.
4. Use the slaking test images and the *Scorecard* to rate whether the slaking result is poor, fair or good.
5. Leave the dishes from 5 cm and 20 cm depths undisturbed for 20 minutes to test for dispersion. Check for dispersion (i.e. cloudiness of milkiness) around the base of the aggregates from the 5 cm depth and the 20 cm depth. Use the dispersion test images and the *Scorecard* to rate whether the dispersion result for each depth is poor, fair or good.

Slaking test

Complete slaking. Aggregates break apart in less than one minute.	1	
Partial slaking. Aggregates remain partially intact.	2	
No slaking. Aggregates remain intact.	3	

Dispersion test

Dispersion present. Obvious milkness after 20 minutes.	1	
Slight dispersion present. Faint milkness observed after 20 minutes.	2	
Not dispersive. No milkness observed after 20 minutes.	3	

Water infiltration

This test involves measuring how fast water can flow into the soil using a hand-made infiltrometer tube. If the infiltration rate is slow, there is an increased chance of run-off from rainfall that can lead to soil erosion. Also, there is less water in the soil for plant growth. Low water infiltration is usually associated with poor soil structure, compaction and gravels, low levels of groundcover and root growth and non-wetting soils. If the infiltration rate is high, runoff is reduced, and more water is available for plants. Very high infiltration rates can result in leaching of nutrients and waterlogging. For more information see *Knowing your soils SA handbook: Soil structural stability*, page 66; *Non-wetting soils*, page 88; *Living roots and cover crops*, page 58; *Soil compaction*, page 64.

1. Find a small area without cracks and other holes in the ground. Trim vegetation and remove sticks and other material.
2. With the ruler in the infiltrometer tube showing 0 at the top, use a board and hammer to push the infiltrometer tube 2 cm into the soil. The top of the tube should be level.
3. Set a timing device (e.g. smartphone or watch) to 6 minutes. Fill the tube with water, start the timer.
4. Note the drop in the depth of the water (in mm) after 6 minutes. If the water drains out of the tube in less than 6 minutes, note the time taken. This will only occur in soils with very high permeability.
5. Multiply the depth recorded by 10. This will give you the infiltration rate (mm/hr).
6. Record the water infiltration rate on the *Soil test results card* and use the *Scorecard* to rate whether the infiltration rate is poor, fair or good.

When you finish testing all the sampling sites, add up the scores for each site and record in the total column. Any improvement in that site year on year will increase the score and give you an indication you are working to improve your soil health.

Setting up your infiltrometer

Assemble equipment: polypipe, secateurs, block of wood, mallet, timer and water.

Clear area of vegetation, sticks and mulch. Make sure there are no surface cracks or holes.

Use mallet and block of wood to push infiltrometer approx 2 cm into soil.

The 0 measurement should be at the top and the infiltrometer should be level.

The infiltrometer in the soil.

Set a timer for 6 minutes.

Fill infiltrometer with water to the top and start timer.

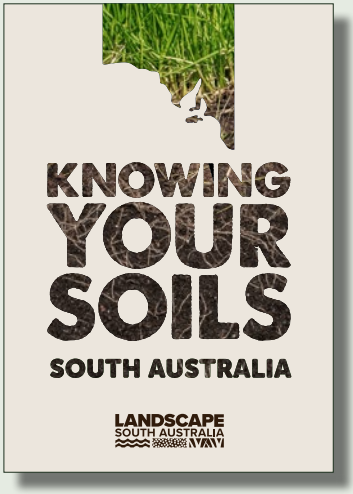
Note the depth of water after 6 minutes. Multiply the depth recorded by 10. This will give you the infiltration rate in mm/hr.

If the water drains out of the tube in less than 6 minutes, note the time taken. This will only occur in soils with very high permeability.

Notes

Understanding your soils will help improve the soil health, profitability and sustainability of your farm.

This guide contains step by step advice to understand the soils on your property and track changes year on year, as well as advice on when to seek help.



Knowing your soils South Australia is the companion reference handbook to this ute guide. It provides additional background information about soils, soil constraints and strategies to assist with the soil management and conservation.