A SOIL STRUCTURE ASSESSMENT KIT FOR IRRIGATED VERTOSOLS

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WHAT IS THE SOIL STRUCTURE ASSESSMENT KIT ?

The Soil Structure Assessment Kit enables you to assess and monitor the structure of your soil. It aims to increase your knowledge of soil, soil structure and how management practices change soil structure. Once soil structural problems have been identified, management practices can be altered to overcome them. Ten properties of the soil are examined by either digging a small hole and looking closely at the soil structure, or making other observations of the soil environment. The soil properties are rated or graded so that you can identify which soil properties are limiting plant growth. If management is changed to overcome a soil problem, the Kit enables you to monitor changes in structure over time and determine if the soil structure is improving. The Kit doesn't provide you with specific solutions to soil problems. However, it will provide you with the information necessary to begin developing a management strategy to overcome specific problems. This should be done in consultation with a soil advisory officer. The type of management strategy will depend on the particular soil problems, farm operations, machinery type etc., so each plan needs to be worked out on an individual basis.

WHY ASSESS SOIL STRUCTURE ?

Poor soil structure is one of the major factors limiting plant production and therefore profit in irrigated agriculture. It can reduce seedling emergence, inhibit plant root development, reduce water infiltration into the soil and increase waterlogging problems. If soil structural problems can be identified and corrected, plants respond with improved performance due to a reduction in growth limiting factors. Assuming the improvements can be economically implemented, this means more money in your pocket, and even more importantly, an improvement in the sustainability of your most important resource - your soil.

WHY IRRIGATED VERTOSOLS ?

The Kit has been designed to deal specifically with Vertosols due to their prevalence in the irrigation districts, and the widespread degradation of structure in this soil group.

Vertosols have properties which make them very susceptible to soil structure decline.

When wet, clay soils become plastic and lose much of their strength. This property makes them prone to compaction and deformation under the stresses of cultivation and traffic from livestock and vehicles. Many Vertosols are sodic, particularly in the subsoil. Sodicity is another property which leads to soil structural decline. High levels of exchangeable sodium in the soil will result in aggregate breakdown due to dispersion. Hence a well thought out soil management program to effectively manage soil structure is an integral part of irrigation farming.

USING THE KIT.

We have tried to make the Kit self-explanatory. However, you will get more out of the Kit if you are first taken through it by an advisory officer. If you are a member of a farm discussion group, ask your co-ordinator to organise a session devoted to the Kit, including a demonstration in the field by an advisory officer.

IS YOUR SOIL A VERTOSOL?

"Vertosol" is a word that will be new to many of you. It has been in use for many years overseas, and is now gaining widespread use in Australia with the introduction of the new Australian soil classification system.

Vertosols are commonly called clay soils. They are distinguished by:

- a high clay content (clay fraction > 35%) in the surface soil and throughout the soil profile;

- cracking which occurs when the soil is dry. These cracks often appear at the soil surface where they are usually greater than 5 mm wide;

- significant shrinking when dry and swelling when wet. This can lead to the development of gilgai ("crabholes") surface features and contact your local Department of Agriculture subsoil features such as slickensides. extension officer.

Examples of these are shown in Figure 1. If in doubt about whether your soils is a Vertosol, contact your local Department of

Figure 1 – Examples of Vertosol Soil profiles

The approximate distribution of Vertosols in Victoria and southern NSW is shown in Figure 2.

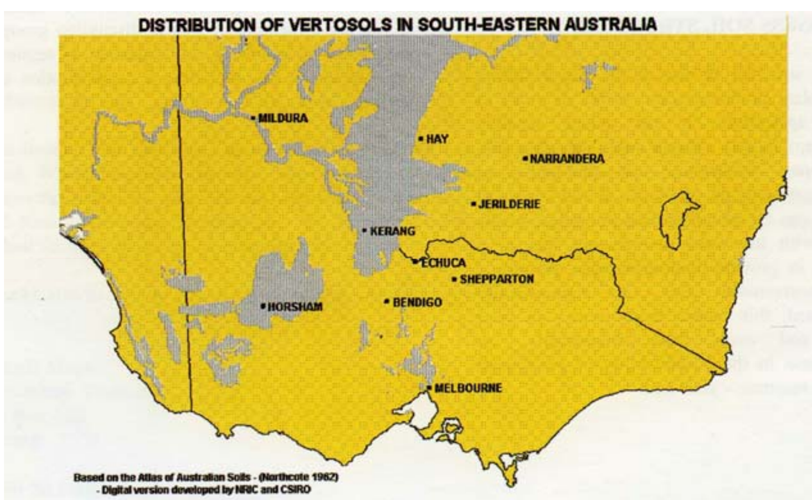

Figure 2 - Distribution of Vertosol soils in Victoria and southern New South Wales. Based on the "Atlas of Australian Soils" (Northcote 1962). Digital version by NRIC and CSIRO

GETTING STARTED

The best and easiest time to examine the soil is when it is moist, so early Spring is probably the best time of year. Wait for a shower of rain and do the work a few days later. A couple of the exercises will require information from Summer observations as well. A knowledge of paddock history should enable you to complete these sections without waiting for the following Summer period.

Each paddock will take approximately an hour to do. Your may choose to do just a few paddocks a year and cover the whole farm in say 3 to 5 years and then return to the paddocks assessed first. This will give the soil time to adjust to any changes in management. It normally takes 2 to 3 years before visible changes in the soil occur after a major change in management. Alternatively, you may be very keen and do all your paddocks in one year. It is up to you and how its fits in with the rest of your program. Talk to your local advisory officer if you would like more advice in devising a program that suits you.

WHAT YOU WILL NEED

The requirements to carry out this assessment are minimal, and are listed below.

- A shovel
- A spatula, or broad flat knife
- A ruler
- This booklet, recording sheet and pencil
- A camera, if you would like a photographic record of the soil profile
- Paper bags for sample collection

CHOICE OF SITE

Once you have decided on the paddock you want to assess, you need to select an appropriate examination site. Try to avoid headlands, and areas of unusual traffic. It is also advisable to stay away from banks, channels and drains. Avoid areas of cut and fill from previous land forming activities unless deliberately targeting these areas.

THE HOLE

To examine the soil structure, dig a hole at least 50 to 60 cm deep (20 to 24”) and 50 cm (20”) wide. You want a hole large enough to have a clear view of one face. It would be advisable to orient the hole so that the side of the hole to be examined, the ‘profile’, faces north and receives plenty of light. If the paddock is in crop dig across the sowing lines to expose the root systems of the plants. Try to minimise disturbance of the soil surface above the profile. Avoid standing on this side and do not heap soil this side. Use the spade or shovel to straighten the viewing face so that it is roughly vertical. The shovel tends to smear the soil. To examine soil structure, the profile needs to be prepared without shovel smears. This is best done by carefully flicking out small amounts of soil with the spatula. Start at the top left corner and push the spatula 1 to 2 cm into the profile 3 to 4 cm below the surface (Figure 3). Use a flicking motion to remove the soil. Move from left to right across the hold. You will notice that the newly exposed soil is rough and not smeared. Continue moving down the profile using the same technique until the entire face is exposed (Figure 4).

Figure 3 – Use the spatula to flick out soil to expose an unsmeared soil profile.

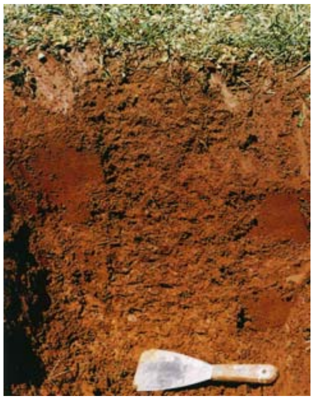

Figure 4 – A prepared profile ready for inspection

Possible crust

Topsoil is usually higher in organic matter than the subsoil, and is often darker in colour

Porosity often decreases as you go down the profile.

Look for deepest root penetration

Figure 5 – Diagram of typical vertosol soil

EXAMINING THE SOIL

When a hole is dug into a soil, the exposed face is known as the soil profile. To the casual observer one soil profile is much the same as the next. However there are distinctive differences which a trained observer can pick up. These differences can mean a lot to a plant root exploring the soil for moisture, nutrition and support. Look at the profile surface carefully and note the changes that occur with depth. For instance, root penetration, porosity, earthworm tunnelling, colour and soil aggregate size.

You are now ready to proceed with a detailed examination of the soil structure. The following pages guide you through a number of exercises and questions which build up a picture of the state of the soils structure. As you proceed, enter the information you gather onto the recording sheet provided. This can then be used as a reference document for discussions with a trained advisory officer or consultant on appropriate soil management.

EXERCISE 1: TOPSOIL DEPTH AND SOIL SURFACE COMPACTION

TOPSOIL DEPTH

Topsoil depth is not always obvious in Vertosols. The boundary between topsoil and subsoil is typically (but not always) 10-30 cm below soil surface. There is often a slight colour change, as well as minor differences in the size and shape of soil aggregates. Subsoils have lower levels of organic matter than the topsoil.

The topsoil is a valuable asset. It stores much of the water and nutrients used by crops and pastures. Any loss of topsoil usually reduces production. This is particularly important in irrigated soils where landforming practices often result in areas with significant topsoil removal.

Measure the depth from the soil surface to the bottom of the topsoil as shown in Figure 6 and enter in the recording sheet.

Figure 6 – Measuring topsoil depth

SOIL SURFACE CONDITION

Surface soil structure has significant implications for agriculture, influencing the workability of the surface soil and seedling emergence. There are four broad classifications.

a) Self Mulching – The soil is friable and forms a loose crumbly surface mulch. Soil aggregates are usually less than 5 mm in size. Self mulching is a favourable condition which makes the soil easier to work and forms a suitable seed bed.

b) Coarse Textured – Soil aggregates are greater than 1 cm in diameter. Generally, as the size of the soil aggregates increases, workability and seedling emergence are reduced.

c) Massive – The surface soil displays very little structure, and aggregates are greater than 5 cm in diameter. When dry the surface often sets hard and cracks.

d) Crusty – The surface soil has a 1-3 cm thick crust.

Using the photographs in Figure 7 as a guide, determine the soil surface condition of the soil adjacent to the pit. If the surface is moist, you may have to defer this test until the Summer, or answer based on prior knowledge.

Figure 7 – soil surface conditions

EXERCISE 2: COMPACTION LAYERS AND POROSITY

Compaction layers (sometimes called hard pans or plough pans) are layers of dense, hard soil with low porosity. They are typically found just below the surface in Vertosols (usually at depths of between 5-40 cm).

When wet, clay soils lose much of their strength and are prone to compression and deformation if stresses are applied (such as regular cultivation or heavy equipment or livestock moving across the soil when wet). This leads to soil compaction and structural decline. When structural degradation has occurred, management options such as reducing traffic from livestock and vehicles, or changing from a cropping to pasture phase, need to be considered to allow the structure to improve.

A well structured Vertosol will have a large amount of fine to medium size (<2 cm diameter) natural aggregates or "peds". These aggregates will have mainly shiny surfaces and numerous roots will be obvious throughout them. Figure 8 shows a well structured Vertosol.

Structural decline occurs when aggregates are excessively cultivated or compressed while in a moist condition. This causes them to be pressed into one another forming large, dense clods. When these clods dry they are very hard and will fracture like rock when broken with an implement such as a mattock. The fracture faces will be "flinty" in appearance and very few roots will be visible. Figure 9a shows a dense degraded layer in the 10 – 30 cm zone of a Vertosol.

Soil compaction often leads to the development of platy structure just below the soil surface. This type of structure does not occur naturally in Vertosols. It is typified by layers of flat, plate-like fragments which break along horizontal fracture planes (see Figure 9b). This type of structure will restrict water, air and plant root movement through the soil. This will invariably lower potential yield, and hence profit. Note that both profiles were excavated in Summer when the soil profile was dry.

Experienced soil scientists can identify these indicators of compaction on a soil face. However this is difficult for the untrained eye.

Figure 8 – Vertosol profile showing good structural development.

Figure 9 – The shape of fracturing in the 10-30 cm layer of these profiles indicate degradation caused by compaction. From the left: a) and b).

We will use two methods to assess compaction and porosity. They are indicative only, and will provide useful information when used in conjunction with other results.

1. Rooting Depth

Soil?

Figure 10a

Figure 10b – An open soil with many visible pores allowing deeper unimpeded root growth.

Figure 11 – A wheat crop direct drilled into a fragile Vertosol. The ridging in the crop is due to tractor wheel compaction during sowing and spraying operations.

EXERCISE 3: SOIL TEXTURE

Soil texture is a measure of the relative proportions of sand, silt and clay in the soil.

The size range (measured as a diameter) of the different particles are:

Clay	<0.002 mm
Silt	0.002 – 0.02 mm
Sand	0.02 – 2 mm
Gravel	>2 mm

The soil is characterised into different texture classes depending on the proportions of these particles.

Soil texture changes little with different management practices. Therefore it will only need to be determined once. Soil texture affects other soil properties such as water holding capacity, porosity, permeability, and the soils behaviour in water.

The clay fraction is probably the most important as it enables the soil to hold water and nutrients. Clay can therefore be considered an active particle. Silt and especially sand however are much less active and hold little water or nutrients.

The texture should be determined in the topsoil (0 - 10 cm) and subsoil (40 -50 cm) separately.

1. *Using the spatula, remove a small handful of soil from the side of the hole (do not use material from the bottom of the hole as it is likely to be a mixture of topsoil and subsoil).*
2. *Remove any gravel, stone or organic litter. Break up the aggregated material.*
3. *Knead the soil to make a ball approximately 4 cm in diameter. Add water a drop at a time to make it more malleable. Stop adding water as soon as the ball starts to stick to the hand. Knead for a further half a minute (Figure 12).*
4. *To determine the texture class you need to manipulate the ball and fell whether the soil is:*

Figure 12 – Kneading the soil to form a texture ball

i) *Gritty – indicating fine and coarse sand. The grinding of fine sand can be heard if you manipulate the ball near your ear.*

ii) *Silky – indicating silt.*

iii) *Plastic/Sticky – indicates clay*

5. *The texture class is also determined by ribboning the ball. Ribboning is done by pressing out the soil between thumb and forefinger (Figure 13). Measure the length of the ribbon (Figure 14). The higher the clay content of the soil, the longer the ribbon length.*

Use Table 1 to determine the texture of the topsoil and subsoil.

Note the texture class in the recording sheet.

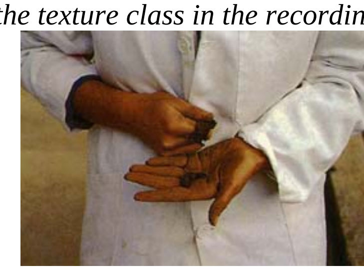

Figure 13 – Ribboning the soil ball between thumb and finger.

Figure 14 – Measuring the length of the ribbon

In Vertosols the texture will nearly always be either light, medium or heavy clay throughout the profile.

Ball	**Ribbon**	**Feel**	**Texture**
Will not form ball		Single grains of sand stick to fingers	Sand
Ball only just hold together	0.5 cm	Gritty	Loamy sand
Ball just holds together	0.5-1.3cm	Sticky, sand grains stick to fingers	Clayey sand
Ball just holds together	1.3-2.5 cm	Very sandy to touch, visible sand grains	Sandy loam
Balls holds together strongly	2.0-2.5 cm	Fine sand can be felt	Fine sandy clay loam
Ball holds together	2.5 cm	Spongy, smooth but not gritty or silky	Loam
Ball holds together	2.5 cm	Slightly spongy, fine sand can be felt	Loam, fine sandy
Ball holds together	2.5 cm	Very smooth to silky	Silt loam
Ball holds together strongly	2.5-3.8 cm	Sandy to touch, medium sand grains visible	Sandy lay loam
Ball holds together	3.8-5 cm	Plastic, smooth to manipulate	Clay loam
Ball holds together strongly	8-10 cm	Plastic, smooth, handles like plasticine and can be moulded into rods	Light clay
Ball holds together strongly	10 cm	Plastic, smooth, handles like plasticine and can be moulded into rods	Heavy clay

Table 1 – Soil Textural Classes

EXERCISE 4: EARTHWORMS

Earthworms are major builders of macropores in the soil. They also play an important role in stabilising soil structure. Their numbers are best assessed during winter or spring when the soil is wet.

Earthworms hibernate deep in the soil over Summer and they become active when the soil moistens in Autumn. They move up to the topsoil where the supply of organic matter, their food, is more plentiful. To extract the organic matter, they ingest the soil and the unwanted solids are left behind as faeces. The faecal pellets are very stable and contribute to stabilising the soil structure.

The earthworms secrete an important mucus-like substance through their skin. It forms a lining on the wall of the burrows and makes them very stable. These burrows may last in the soil for decades if undisturbed.

Earthworms are therefore a good indicator of the health of the soil and its structure. The more organic matter a soil contains the greater the potential number of earthworks and macropores.

Cultivation and stubble burning reduce earthworms numbers by reducing their food source (organic matter). Stubble on the soil surface encourages earthworms to burrow up to the soil surface and open channels from the subsoil to the soil surface as they go.

Figure 15 - Earthworm

Move away from the hole and take a shovelful of soil (approximately 20 cm (8") square and 10 cm (4") deep and separate out the worms (Figure 16). You will need to do this several times to get reliable numbers. Calculate the average earthworms number by totalling the number of earthworms and dividing the number of shovelfuls tested.

Note the average number of earthworms in the recording sheet.

Generally:

0-2 earthworms per shovelful …….Poor
3-5…………………………………Good
> 5…………………………………Great

Earthworms aren't the only soil animals that build up soil structure. Ants and termites are also good for the soil. Note in the comments sections of the recording sheet if you see any.

Figure 16 – Sorting soil for worms

EXERCISE 5: SOIL CRUSTING

Soil crusts are commonly seen on the surface of drying soils.

Crusts are a significant soil structural problem because:

a) They restrict water movement into the soil and cause ponding, waterlogging and increased runoff.
b) They restrict air movement into and out of the soil.
c) They may prevent seedling emergence.

Crusts can form through two processes:

i) clay dispersion, and
ii) aggregate slaking

Both processes usually contribute to crusting on Vertosols.

1. Clay Dispersion

Clay dispersion is a chemical process. It occurs when individual clay particles separate from one another in moist soil and move about in water. Clay is an active particle in soil, and will behave differently under varying conditions. When the clay contains a lot of sodium (a constituent of common table salt) it tends to readily disperse in water. You often see dispersed clay in puddles and wheel ruts (Figure 17).

Very cloudy water is a good indicator of dispersion. The cloudiness is dispersed clay. As the water evaporates, the dispersed clay settles into pores and forms a seal over the soil surface. On drying the seal forms a crust. Vertosol soils often contain large amounts of sodium (sodic soils), and dispersion and crusting commonly occur.

Gypsum is used to treat soils with dispersive clays. Gypsum contains large amounts of calcium. The calcium replaces the sodium in the clay. A clay that contains a lot of calcium does not disperse when it becomes wet.

Figure 17 – Dispersed clay in a puddle

2. Aggregate Slaking

Unlike dispersion, slaking is a mechanical process and occurs when the soil structure is weak. When a dry soil is wet rapidly (e.g. with heavy rain), water moves into the pores within the aggregate and forces air out. If the aggregate is weak, the force of the escaping air causes the aggregate to split apart. If the aggregate is strong, then it resists the force of the escaping air and holds together. (Raindrops falling on to the soil surface can also cause weak aggregates to fall apart). The aggregates break down after slaking to smaller particles called microaggregates. These are washed into the soil and block soil pores and form a crust on the soil surface.

Organic matter plays an important role in determining the structural strength of the soil. It is a most important binding agent or soils glue. Vertosols can vary enormously in their organic matter content, and hence their susceptibility to slaking. Increasing the organic matter content of the soil will increase the soil strength and prevent slaking.

In the next exercise we will test the soil to see if it slakes or disperses.

Move away from the hole and compare the crust on your soil with those shown in the photos below, giving it the appropriate rating. Note the rating in the recording sheet.

Severe Crust

As the surface dries and the clay shrinks, plates crack apart and form. The crust can be up to 1 cm or more thick. The surface of this soil is smooth. The aggregates have broken down and the fine particles have washed into the soil to form a crust. There are not visible macropores in the surface.

Figure 18 – A severe crust on a cultivated Vertosol

Intermediate Crust

Some aggregates are intact though they have a smoothed appearance due to some breakdown. Some macropores are visible (ignore cracks, as these are caused by shrinkage of the crust on drying). There has been some sorting of the fine grains on the soil surface.

Figure 19 – Intermediate crust on a cultivated Vertosol

Minimal Crust

Aggregates are intact, quite a few macropores are visible, there has been no sorting of grains.

Figure 20 – A minimal crust on a cultivated Vertosol

Note that these photos represent crusts on cultivated soils.

EXERCISE 6: SOIL STABILITY TEST

This is a simple test used to determine if your soil is dispersive and if it slakes. It is a modification of a test used in the laboratory called the Emersion Dispersion Test. As we have modified the Emersion Dispersion Test, the rating you give the soils would be different to the "Class" that a laboratory test will give the soil. Please note that you should not try and compare the two results which may be quite different.

This test is best carried out at home.

You will need two shallow, flat bottomed, clear containers (e.g. saucers) and about a cup of rainwater or distilled water. Do not use bore, river or dam water as this will alter the results of the test.

1. *Collect a handful of soil from 0-10 cm (0-4"), 20-30 cm (8-12"), and 40-50 cm (16-20") down the profile, placing in separate buckets or paper bags. Avoid using plastic bags as these will cause the soil to sweat.*
2. *Samples used need to be collected from the paddock and carried back to the house or shed with a minimum of disturbance.*
3. *Store the samples in a warm dry place until the samples dry. If the soil is wet, this may take a couple of days. It is very important that the soil is dry before carrying out the test.*
4. *Select 3 aggregates approximately pea-sized form each sample. Put enough water in each dish to cover the aggregates (6 to 10 mm deep) and then place the aggregates carefully into each dish. Use one dish for each set of aggregates.*
5. *Watch the aggregates carefully for the first few minutes. Slaking will occur almost immediately if it is going to happen at all. You will see small bits of soil fall off the side of the aggregate, small bubbles of air escaping from the aggregate and eventually the entire aggregate may fall apart (refer to Figure 21).*

Figure 21 – Aggregates showing slaking. Form left: minimal and significant

6. *Leave the samples for 20 hours before checking for dispersion. In some soils, it will take this long for dispersion to be visible. Dispersion is indicated by a cloudiness or milkiness around the base of the aggregate.*

If dispersion is complete, then the bottom of this dish will be covered by the cloud. If dispersion is incomplete, then the cloud will just surround the aggregate (Figure 22).

7. *Note in the recording sheet if complete, incomplete or no dispersion occurred.*
8. *If no dispersion occurred, move onto step 9. Otherwise, use the diagram on the next page to determine the stability of your soil.*
9. *If no dispersion occurred, then the soil requires a further test, called remoulding. Make a moist ball using exactly the same procedure for making the texture ball in Exercise 3. Out of this, make 3 pea-sized balls and place them in a dish of water prepared as in step 4 above. This remoulding test is designed to determine how a soil will behave when it is cultivated or overstocked in a wet state.*
10. *Repeat points 6 and 7 above. (Slaking does not apply to a moist aggregate).*

11. *Use the diagram below, to assess the stability of your soils, and record the results for each sample on the data sheet.*

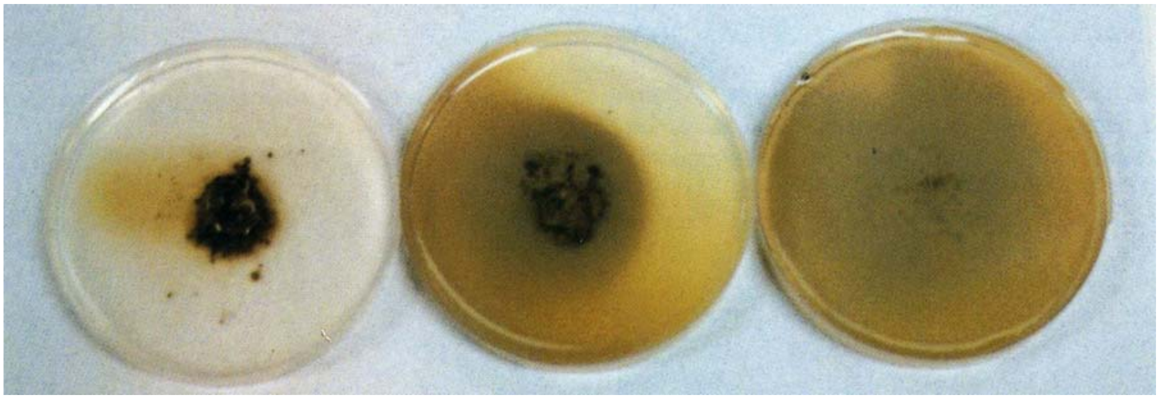

Figure 22 – Petri dishes showing dispersion levels.
From left: little or none; incomplete and complete dispersion

Type 1

A cloud will cover the bottom of the dish in a very thin layer. The only thing left of the aggregate will be a small heap of sand grains and/or some organic material.

In the field this soil may suffer from severe crusting, erosion and poor drainage. It is not a condition suited to regular cultivation or cropping. Gypsum application will probably be necessary if it is to be used for cropping. A laboratory test will be valuable to determine how much gypsum to put on.

Type 2

A cloud of dispersed clay around the aggregate which usually spread in thick streaks and crescents on the bottom of the container.

In the field, a Type 2 topsoil will have similar problems as the Type 1 soil but not to the same degree. Again, it would be advisable to get the soil tested by a laboratory.

Type 3

This soil type only disperses after clay has been remoulded when moist. This means that very sound management practices can avoid crusting and erosion but there is not much room for error. Gypsum again could well be useful to change the soil from a Type 3 to Type 4.

Type 4

The aggregate structure of the soil is pretty stable. This soil should not crust and should have reasonable rates of water infiltration.

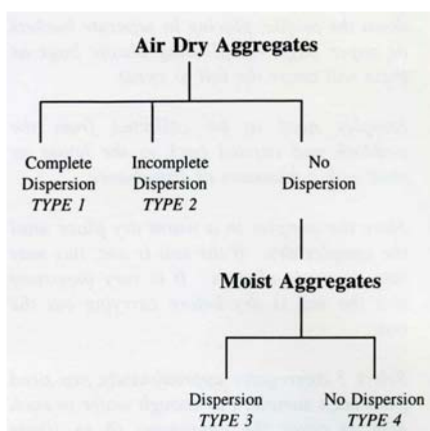

Figure 23 – Soil Stability Classes

EXERCISE 7: LEVEL OF CRACKING IN DRY SOIL

The degree of cracking in a Vertosol is largely a function of the percentage of clay in the soil, the type of clay minerals present in that soil, and the moisture content of the soil down the profile.

The level of cracking in a soil helps us understand how the soil will respond to tillage and irrigation practices, and indicates the soil's ability to recover from compaction problems through natural shrinking and swelling. It will also help us determine irrigation refill points for various crops and pastures.

This observation needs to be deferred until late Summer, unless you can recall the behaviour from past years. The visual assessment can be more difficult if livestock have been in the paddock during summer, as they tend to trample loose surface soil into the cracks.

Question

Does the soil under investigation exhibit severe, moderate or low levels of cracking in late Summer following an extended period of dry weather? The photos below area guide to assist you.

Figure 24 – Vertosols showing (L to R) minimal, moderate and high degrees of cracking

EXERCISE 8: SOIL SALINITY

Many of the soils in the irrigation areas have moderate to high levels of soluble salts in the subsoil. As watertables rise, these salts dissolve in the groundwater and are brought closer to the soil surface.

In extreme situations these salts accumulate in the rootzone and on the soil surface. The increase in salt levels modify some soil structural characteristics, and usually reduce plant growth.

The first visual sign of salination is usually the degradation of pastures, with sensitive species such as clovers being lost. As the severity increases, salt indictor species become prevalent. Examples of this are shown in Figure 25 below.

Soil testing is the easiest way of quantifying salinity if you are concerned that a problem may exist.

Question: Are you aware of a possible salinity problem in the paddock being assessed?

Question: If so, do you consider it a moderate or serious problem?

Some farmers will have recent soil tests or EM38 salinity survey data. Use this information if it is available.

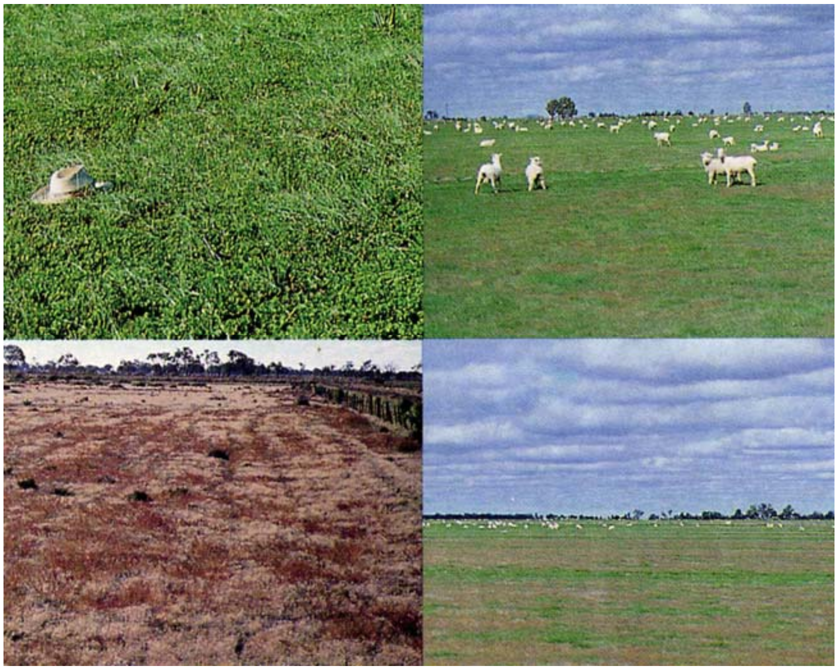

Figure 25 – Annual pasture growth on soils with varying soil salinity.
Clockwise from left: low; moderate; high and severe salination.

EXERCISE 9: WATERTABLES

The presence of a watertable close to the soil surface indicates a soils susceptibility to waterlogging and salination. This in turn creates a rootzone environment which can seriously affect plant growth. The salinity of groundwater also influences soil properties and is important in determining how to manage a watertable problem.

Soils with a watertable problem can still be very productive, however appropriate soil management is critical.

Regular monitoring of watertables on your property is a good idea and Figure 26 gives and outline of a simple testwell for installing on your farm. For further information contact your local extension officer.

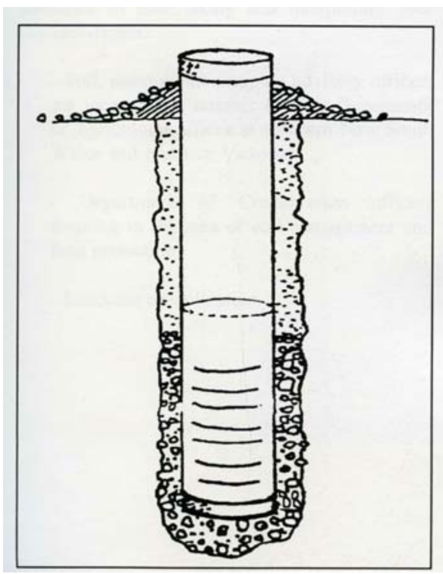

Figure 26 – Diagrammatic presentation of a simple testwell design

Question:

Is the watertable in the paddock being investigated less than 2 metres from the surface for much of the year?

If yes, do you know what the salinity of the groundwater it?

Note: If unsure about these question, your local Department of Agriculture office or irrigation water distribution centre should be able to assist.

Dig hole in soil using 100 mm diameter auger

Pipe should be made from 40-50 mm PVC

Backfill slotted area with gravel or sand

Bottom 50 cm slotted using a saw

Testwell should be at least 2 m deep

EXERCISE 10: IRRIGATION LAYOUT

Modern landforming techniques utilising Whole Farm Planning and laser assisted grading have led a revolution in irrigation design and management. This in turn as allowed greater flexibility in land-use options for farmers, due to greater control in applying and draining water from the soil surface.

While irrigation layout is not specifically related to soil structure, the state of the irrigation infrastructure will influence advice provided regarding amelioration of soil structural problems.

Questions:

Has the paddock been "laser graded"?

If yes, What is the slope?

If no, does the paddock irrigate and rain well?

Have sections of the paddock had significant areas of topsoil removed?

Does the paddock have access to good surface drainage?

COMPLETING THE ASSESSMENT

The assessment of your soil is now complete. Check that you have fill in all the details on the recording sheet. Also, note any comments or observations you have made while examining the soil.

Ideally you should go through the results with an advisory officer or your consultant. Together you can identify the soil structure problems liming plant growth and develop a soil care program to overcome them.

If you have used the kit before, compare this years results with that collected in previous years. Look for improvements or deterioration. Remember that it may take a number of years for the soil to respond.

Soils are one of our most neglected assets. An ongoing soil management strategy is a vital part of a sustainable farming system. Good luck in developing and implementing yours!

CONTACT POINTS

The following people should be able to provide assistance in undertaking and interpreting your soil assessment:

- Soil, pasture and cropping advisory officers are located in a number of state Department of Agriculture offices in southern New South Wales and northern Victoria.
- Department of Conservation (now Department of Primary Industries) officers working in the area of soil management and land protection
- Landcare co-ordinators