Growing Your Own Food at Home in Salisbury Series

Pack C Notes 3 SOIL – TEST, ASSESS & TTHEN PREPARE

Starting a veggie patch

Most of soils in Salisbury Council are clay with a good mineral mix and water holding capacity, with some alterations they will grow healthy vegetables. If you have an established garden with improved soils then you may be able to start your vegetable garden quickly and easily simply, as you already have some of the essentials to success. Establishing your food garden may be as simple as starting with one or two simple vegetable crops planted in between existing plants i.e. lettuce in a flower bed.

If you wish to grow in dedicated garden beds and your soil is open and loose it may not need much preparation. To a vegetable patch select a suitable bare patch of ground, weed by hoe, loosen the soil, give it a deep soak and plant some seeds or seedlings. Apply a little fertiliser at planting, put 1-2 cm of compost on top of the soil, without digging in, and mulch (mulch depth varies according to the season). That simple!

Need for soil preparation

However, most soils need a bit of preparation to produce good long-term harvest of highly nutritious food plants the soil and altering is essential when growing in the ground. For new beds initially this preparation work will include: increasing drainage (though not on the coastal sands) and building soil fertility. When planting new crops, especially heavy feeding ones, you will need to add additional fertiliser either at the beginning or over the season.

In addition to drainage and soil fertility, pH (acid/ alkalinity) range also affect the health of plants and will need to be addressed.

A little knowledge about plants and how they interact with soils may assist in understanding why these measures are necessary.

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What plants need from soils

- Stable structure - for their roots to grow in
- Water - for nutrient transfer
- Air - as food
- Nutrients - food supply

Plants get their nutrients and water via their roots. Their roots take up nutrients by absorbing them from water in the soil; selecting nutrients needed by plants. Hence, they need a soil structure that allows them to move through and locate the nutrients; air spaces in soils allow movement. For plants to be healthy there needs to be enough of the right type of nutrients in the soil in an available form (soluble) and the right amount of water to dissolve them in for uptake.

Most of the roots in typical garden plants are located in the top 30 - 50cm of soil and this is the main area where alterations are focused.

For a soil to be good for food production it needs to contain the following 5 elements:

1. Mineral particles - rock in various states of being weathered
2. Organic material - humus, dead and decaying parts of plants and soil animals
3. Water - nutrients for plants are dissolved in water forming a soil solution
4. Air – fills spaces between soil particles and is not filled with water.
5. Living organisms – various from viruses to small animals

These factors are important because they all relate to the ability of plants to move their roots into the soil to be able to extract available nutrients; availability of obtainable nutrients in the soils; and oxygen levels in the soil.

Salisbury soils will need altering to be able to grow healthy vegetables in the long term. These alterations will be to the pH, drainage, texture, and organic matter levels.

Plants get their supply of water and nutrients from the soil via their roots. Soils need to be free draining, moist and fertile to produce health veggies

To find out which specific changes will be required in your garden soil testing these factors is necessary. You can engage a professional soil analysis service ordo some test yourself. When getting professional soil analysis ask for: pH, salinity, availability of phosphorus, trace elements and recommendations for what fertilisers to use.

Testing the soil's pH, texture, drainage, structure and organic matter content will guide you to what actions are specifically necessary to set up your produce garden for long term success.

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Information about these factors of soils, how to test them and remediation for them are outlined below.

Testing the soil

SOIL pH

The soil pH is the measure of its range of acid and alkaline: pH 7 is neutral; below pH 7 is acid and above is alkaline. Plants have evolved to suit their original growing region consequently preferred pH ranges to grow in. Growing them in soils outside their preferred pH range will affect the availability of nutrient elements in the soil to them, even if the nutrient are there and consequently plant growth and health.

Indications can be commonly seen in leaf colour and stunted growth. Most vegetable grow well between pH 6 to 7, and many can tolerate a bit either side of this range, which is helpful for gardeners.

There is some leeway for growing plants outside of their absolute preferred range plant from:

- pH 4.5 (acid) can often tolerate close to pH 6 (slightly acid);
- slightly acid (around pH 6 can tolerate a range from pH 5.5 to 7 (acid to neutral);
- alkaline regions can tolerate a around pH 6.5 (slightly acid).

With most (though not all) soils in Salisbury council area alkaline, (though not all) their pH will need to be lowered to neutral. To test the pH use a CSIRO/Manutec testing kit, available from gardening stores. Changing pH takes time.

Lowering pH in alkaline soils can be done by adding agricultural sulphur for soils pH 8 and below. Follow the recommendations on the container.

Raising pH in acid soils can be done by adding ground limestone, or hydrated lime (calcium hydroxide), also called builders lime which is the quickest. Builder's lime will take a few months to finish its work in the soils. Ground limestone may take up to1 year. The amount needed will depend on the amount you need to change the pH by.

It's worth noting that using alkaline water, Adelaide's water alkaline at around pH 8, will increase the pH. Grey water from laundry (washing machine water) can be very alkaline if using powder detergents.

If your soils are alkaline, as are most in Salisbury, don't add lime to your compost.

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SOIL TEXTURE

Like fabric, soils have textures -they feel different; gritty/rough or smooth. This is because of what they are made of; the size of their particles, and the proportions in which these particles are present. Think of the difference in feel of a gritty sandy beach verses slippery wet clay.

The texture affects the soil's ability for water to flow through it –

water drainage and retention → affects fertiliser leaching → affects how you need to fertilise soil.

- Sandy soils (including sandy loams and loamy sands) drain easily and fertilisers leach through them into the subsoils and away from plant roots.

- Clay soils are generally sticky when wet, and drain slowly.

Testing your soil texture type will indicate the necessary preparations required to the non-living mineral aspects of your soil. Tests are outlined below, and include a test for water repellence (water up-take test). Start by taking a soil sample from your garden. As there may be different types of soils in throughout your garden you may want to take numerous samples from different areas.

Take a sample:

1. With a spade, dig a block of soil spade width to 10cm depth, 5 cm across
2. Extract two tablespoon of the soil from the lower part of the block
3. Feel the soil in the following two ways

Finger and Thumb Rub Test:

- Rub between finger and thumb to feel its texture
- Does it break up easily?
- How does it feel - smooth and silky or gritty?
- Are the gritty bits large or small, firm or soft?
- Does it squish down? It is good if it does as it means it has air spaces and well-formed structure

Water Up-take Test to see if your soil is water repellent:

With the same sample

- Add a little water to moisten the soil and observe its action
- Ideally, the soil will darken as it absorbs the water
- If the water sits on the surface, your soil is water repellent and measures need to be taken

Kneading Test:

With the same sample (moistened one from above)

- Remove any gravel or sticks, place in palm of one hand
- Knead it (add more water as necessary a little at a time) so it is well 'mixed' and feels consistent (like needed scone mixture with one hand!)
- Try to make a ball or sausage shape. Is this possible or not?
- Try to roll it out to make a 'ribbon' by sliding it between thumb and forefinger
- If successful in this see hold long you can make your 'ribbon' before it breaks up

Note if you have sandy soils you won't even be able to form a ball let alone a ribbon!

What the soil texture results mean

In sandy soils you will feel hard grains and it will break up easily. There soils are easy to dig, will drain quickly, (unless water repellent) but this means fertilisers will leach into subsoils quickly too.

Clay soils will feel silky as the individual particles are too small to feel, and will hold together enough to be shaped. There are different types of clay, generally they drain slowly, are hard to dig – sticky when wet and hard set when dry.

Loam soils are considered the best soils for the home produce grower; they contain particles of varying sizes as in a mixture of sand and clay, and you can feel the sand as a gritty texture when rubbing and

kneading but the clay and humus (organic matter) hold it together when kneading or rolling. They are good because they offer a balance between drainage and holding enough water for plants to use, and allow plant root to move through.

Soil are named depending on their components. As a gardener you will encounter descriptive names for soil types which give some indication of their texture and drainage.

- Sand, Loamy sand, Sandy loam
- Loam, Silty clay loam, Sandy clay loam
- Sandy clay
- Clay- medium to heavy

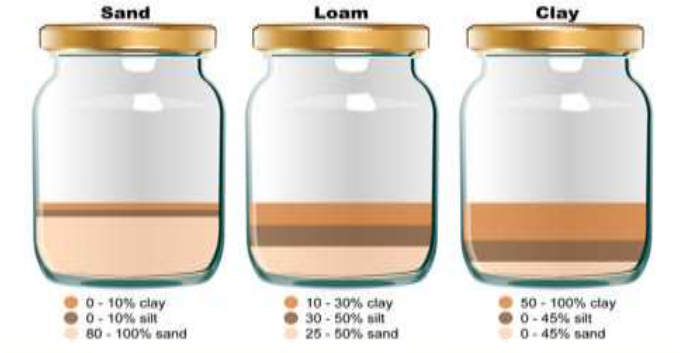
Good soil is 50% solid -minerals and organic matter, this is where the insoluble nutrients are and 50% open where the 'pore' space holds air and water and soluble nutrients are available

Sandy soil **Clay soil** **Good soil for produce growing: open and full of life**

Soils can be categorised depending on the percentage is sand, clay and organic materials present. This can be tested in the Shake and Sit Test (instructions below) and can help guide you as to how what type of soil you have and what needs to be changed for it to be more suitable from growing produce.

Shake and Sit Test:

- Fill a screw top jar half with 1/3 soil sample and 2/3 deionised*/rainwater, secure the lid and shake hard
- Leave to settle for 48 hours
- The bottom layer will be sand, the middle layer will be organic matter and the top will be clay
- Measure the layers to determine % of each material
- If the water is still cloudy it has colloidal clays (fine negatively charged particles). This causes water logging and lockup of the available minerals.



SOIL DRAINAGE

Relating to soil texture, drainage; whether soil is free draining, or holds water. It affects plant health because if soils don't drain well and become waterlogged the oxygen movement into, and cardon dioxide movement out from, the soil is slowed, and chemical changes occur in the soil to produce a toxic mix. In both of these conditions a plants health is severely impacted, reducing its immunity therefore increasing susceptibility to diseases. Sour smelly soil often means it has poor drainage. Most of the soils in the Salisbury region are clay soils. Generally, they have good water holding capacity and mineral content, however, they also have poor drainage which can lead to waterlogged plants that die in winter. If you have heavy clay or compacted soils (water penetration is very slow, it is difficult to dig or it sets very hard on drying) you may need to loosen it up to create air holes and improve drainage before planting. This is the first preparation to do when establishing new beds.

Testing the drainage of your soils over several areas throughout your garden is recommended.

Testing drainage by:

- Dig a hole 15 cm deep and 5 cm across
- Fill up to 5cm with water, wait until this has soaked away
- Add another 5cm depth of water, wait until this has soaked away
- Repeat this process two more times
- On the fifth time, after adding the water, time how long it takes for the water to drain away

Well drained soils will drain away in 3 hours or less.

Poorly draining soils will take longer than 10 hours. Remediation will be required which may include a drainage system.

It is also useful to know where water is going and whether it is staying; there may be areas of your garden where water pools especially if it slopes. When it rains watch the water run-off and note where it pools, test the drainage of these areas if water seems to sits for a long time. Using swales can be an easy way to guide water.

REMEDIES FOR POOR DRAINAGE

To improve heavy or sticky clay or compacted soils

- Add gypsum, up to 1 kg per square metre
- Add coarse sand, double washed builders/river sand 5 - 10 cm thick

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- Dig down to 30 cm deep and mix gypsum and sand into clay
- Add organic matter and fertilisers to the soil surface, do not dig in

To improve normal clay soils

- Add 5 cm layer of coarse sand and dig into top 10 - 20 cm
- Open up by digging and turning top 10 - 20 cm of soil
- Loosen deeper layers below with a fork, do not dig up deeper soil to mix with topsoil
- Add organic matter and fertilisers to the soil surface, do not dig it in

Plants can also be used to open up soil. Direct sow plants with tap roots such as beetroot, borage, carrots, celery, chicory, dill, endive, fennel, parsley, parsnip, mustards, rocket and silverbeet for one season. When you harvest them, cut back at the base and leave the root system in the soil. The micro-organisms can now move through the soil easily and those which live on the roots are kept in the soil.

DIG INITIALLY THEN NO DIGGING

Once you have dug these soils you should not need to dig again, except when planting seedlings.

Digging soil opens it up to the air and if it dries out many of the living things in it die.

Note: compost and clay are similar particle size therefore don't keep digging it in as it affects the soil structure.

To improve sandy soils

Because fertilisers leach out of sandy soils easily, using slow release fertilisers will keep the nutrient supply to plants more effectively. Compost is good for these soils (and will seem to disappear very soon), so for long term effect of improving water hold capacity, add clay. Or resign to a regular regime of applying water, and soluble fertilisers.

For the veggie patch (and other areas of the garden you want to thrive) you may find you need to use a lot of water and fertilisers to keep your plants thriving. Therefore, it may be cost effective to take more permanent measures in these soils. This means increasing the clay content to approximately 15 - 20% to the root zone (top 15 – 30 cm), which can be done by adding ¼ of clay per ¾ of sand.

Adding clay to sandy soils:

- Lay a clay layer of approximately 5 - 10 cm on top of the soil
- Add another 10cm layer of compost
- Mix thoroughly into the top 15 - 20 cm of soil
- Add a thin layer of compost on top and mulch. Do not dig this layer

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Do not dig wet or waterlogged soil, or walk on moist soil after it has been dug as it will become too compacted.

Non-wetting soils

Those who live in coastal regions will be very familiar with the non-wetting phenomena of soils where water can sit on the surface of dry soils for hours. You may even have resorted to jumping on the soils in the rain or under the sprinkler to drive it in (yes, this works and could be fun for the grandkids).

The addition of compost can cause non-wetting soils, because of waxy substances produced by decomposing material and their flora and fauna. To deal with these water repellent soils follow the above measure, or similarly adding 10 – 15kg of clay per square metre and mix into top 10 cm of soil. This can help your sandy soils more permanently deal with this.

For more temporary measure to deal with non-wetting soils, and maybe more feasible in many situations, a wetting agent can be used to improve water uptake. These are special detergents

Applying non-wetting agent:

- Make small holes in the soils with a fork
- Follow recommendations Apply wetting agent
- Temporary measure to deal with non-wetting soil involve applying a non-wetting agent
- Recommended dilution of 5 ml per 2 litres of water
- Extra forking in may be necessary
- Slowly irrigate (low rate approximately 5- 10mm per hour)

The non-living mineral 'texture' has been improved there are a few other factors to look at to bring soils to quality ready for growing produce

SOIL STRUCTURE

Related to soil texture and drainage, soil structure relates to how it crumbles. Soil structure:

- Ties in with soil fertility and the living parts of the soil
- Is a factor that allows plant root penetration
- Brings oxygen into the plant's root zone
- Allows water to absorb in and excess to drain out

It's about the air spaces (between the solid particles) and the more solid parts, and they relate to each other. The more solid parts are aggregates; a combination of mineral particles and humus.

Attributes of good structure are:

- Holding together when dug, or its rains
- Allowing penetration of roots

Humus is highly decomposed organic matter (plants, bacteria, fungi, and small animals). It darkens soils.

Humate is the black stuff and is the purest form of natural organic matter known to man and it is one of the most complex substances on earth. **Humate** is highly concentrated into a solid material, similar to coal. **Humate** is the generic name for soil humic substances.

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- Water air and carbon dioxide exchange
- Particles approximately 2 - 3 mm across

Creating good soil structure in food beds can mean less digging; healthy plants as they expend less energy to get their roots into the soils and directing them to where the nutrients are; more stable moisture levels in the soils allowing plants to access soluble nutrients more readily.

These essential soil aggregates (combination of mineral particles and humus) are held together by: living organism; the secretions of these organisms; and clay particles.

BUILDING SOIL STRUCTURE

Soils in this region are deficient in organic matter, and to have healthy plants utilise the symbiotic relationship between plants and microorganism that build plant health you need to build the organic matter levels in the soil. This topic relates to building the soils and is covered in Pack C Notes 4 Fertilising Soils and Notes 5 Microorganism.

We end these notes general recommendations for preparing your soils for growing produce are to:

1. Bring pH to neutral in alkaline soils by: applying agricultural sulphur
2. Improve structure by: applying gypsum in clay soils, and clay to sandy soils
3. Add as much compost as you can
4. Add concentrated fertilisers to overcome deficiencies

Composts (with manure in it) or manures will usually supply enough of the other trace elements so add them liberally.

Recommended reading:

Gardening Down - Under A Guide to Healthier Soils and Plant, Kevin Handreck, CSIRO Publication, 2001, ISBN 10 0643066772

Teaming with Soils, 2010, Teaming with Microbes: The Organic Gardener's Guide to the Soil Food Web, Book by Jeff Lowenfels and Wayne Lewis ISBN 10 1604691131

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