Fieldwork Booklet

Soil Testing

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STUDENT NAME ..... TEACHER .....

Description

Soil is the top layer of the Earth's crust in which organic matter grows. There are many components that determine soil type and quality. The ones we will be examining include pH, Texture, Structure, Slaking and Dispersion. These factors influence the type of plant or crop that can grow in that location. The best way to determine soil quality is by conducting a series of soil tests.

Aim

To investigate the difference in composition between a fertile agricultural soil and an infertile soil.

Outcomes

- GE5-1 explains the diverse features and characteristics of a range of places and environments
- GE5-2 explains processes and influences that form and transform places and environments
- GE5-3 analyses the effect of interactions and connections between people, places and environments
- GE5-7 acquires and processes geographical information by selecting and using appropriate and relevant geographical tools for inquiry

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Glossary

- **pH –** Soil pH is a measure of the acidity and alkalinity in soils. pH levels range from 0 to 14, with 7 being neutral, below 7 acidic and above 7 alkaline.
- **Texture –** An estimate of the relative amounts of sand, silt and clay particles in a soil.
- **Structure –**The arrangement of the solid parts of the **soil** and of the pore space located between them. It is determined by how individual soil **granules** clump, bind together, and aggregate, resulting in the arrangement of soil pores between them.
- **Slaking –** The breakdown of a lump of soil into smaller fragments on wetting. It is caused when clay swells and the trapped air bursts out. Organic matter reduces slaking by binding mineral particles and by slowing the rate of wetting.
- **Aggregates –** Groups of soil particles that bind to each other more strongly than to adjacent particles. The space between the aggregates provide pore space for retention and exchange of air and water. Commonly referred to as a "Sod".

Geographical Tools

- 2 x Small dish
- Distilled water
- Soil pH kit
- Pen and pencil
- This booklet

Field Sketch

In the boxes below, compose a field sketch of each area you are testing – Ag Farm

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Other: _____

What is this area primarily used for? _____

Soil Texture

About soil texture

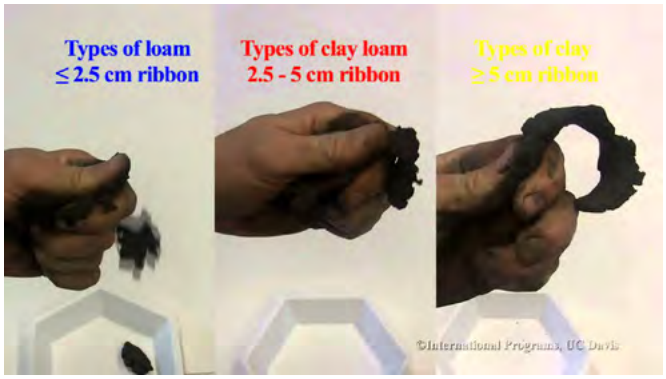
Texture is the 'feel' of the soil. This will depend on the various sizes of grains that make up the soil and the proportions of different sized grains. The different amounts of these particles, or grains in a soil sample are used to classify soils into a texture group. These groups range from pure sand to pure clay.

Soil texture affects:

- how the soil holds water
- how water can seep down into the soil (porosity)
- what happens when the soil is cultivated (ploughed)

Method

1. Collect a sample of soil 1 (about a handful). Check the soil for any lumps, stones or organic material. Break/ remove any that are present.
2. Add water to the soil sample. Water should be added slowly, one drop at a time.
3. Whilst adding water, knead the soil to make a small ball that sticks together and is moist.
4. Using Chart A: "Soil texture flow chart" determine what soil type you have.
5. Press the soil between your thumb and forefinger to make a ribbon.
6. Measure only the length of the part of the ribbon that is not broken.
7. Use Chart B: "Soil texture Table" to determine the texture class of your sample.
8. Record results in the table on the 'Results table'.
9. Repeat steps 2–9 for soil 2.



Ribbon Test Source: https://www.youtube.com/watch?v=GWZwbVJCNec

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Chart A: Soil Texture Flow Chart

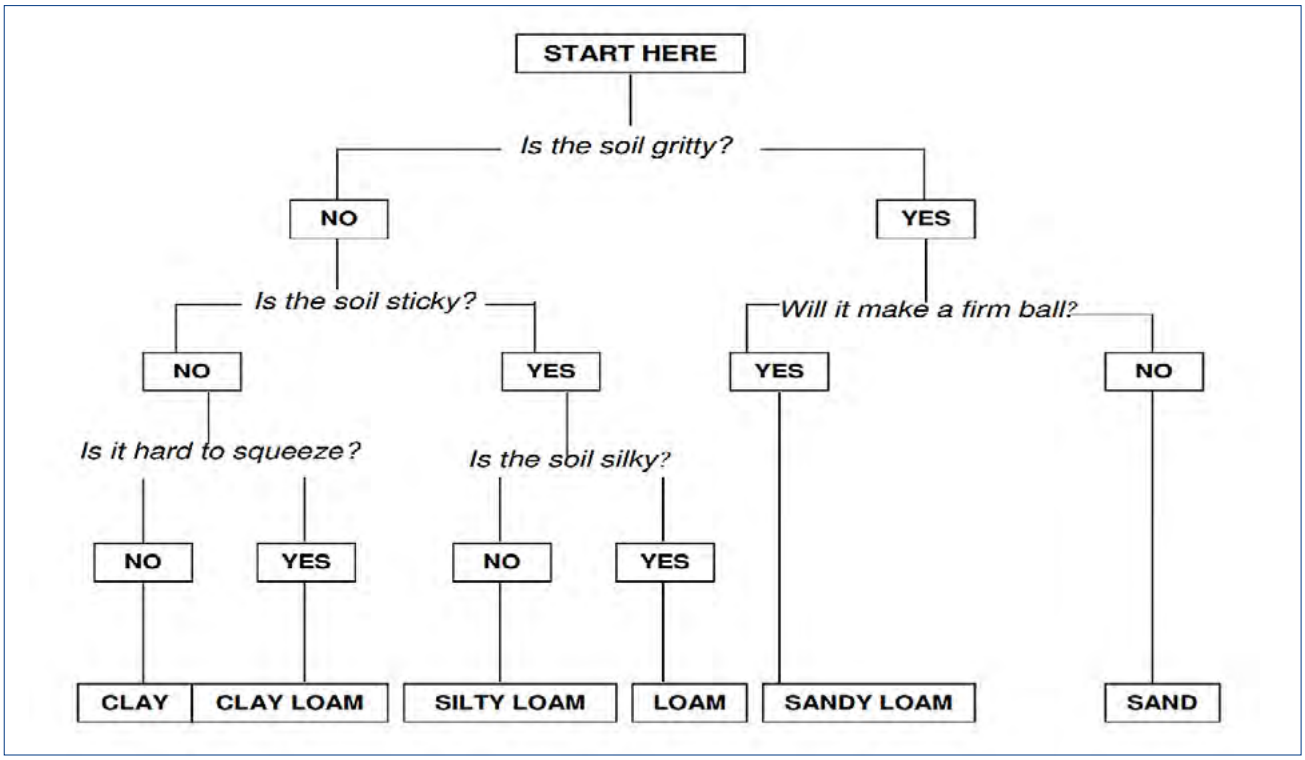

Chart B: Soil Texture Table

BALL	RIBBON LENGTH	FEEL	TEXTURE
Will not form a ball		Single grains of sand stick to fingers	Sand
Will only just hold together	0.5cm	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 – 2.5cm	Very sandy to touch, visible sand grains	Sandy loam ball
Just holds together	1.3 – 2.5cm	Fine sand can be felt	Fine sandy loam ball
Holds together strongly	2 – 2.5cm	Sandy to touch, sand grains visible	Light sandy clay loam ball
Holds together	2.5cm	Spongy, smooth but not gritty or silky	Loam ball
Holds together	2.5cm	Slightly spongy, fine sand can be felt	Silt loam ball
Holds together	2.5cm	Very smooth to silky	Loam ball
Holds together strongly	2.5 – 3.8cm	Sandy to touch, medium sand grains visible	Sandy clay loam ball
Holds together	3.8 – 5cm	Plastic, smooth to manipulate	Clay loam

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Soil pH

Summary

Soil pH is an important concern for farmers and gardeners for a range of reasons as it affects soil health and the plants and animals that live in it. The measurement of soil pH tells us how acidic or alkaline the soil is. The range used for measuring pH is a scale from 0 (acid) –14 (alkaline). A pH of 7 is neutral. pH is dependent on the activity of hydrogen ions (H+) in solution.

A low pH measurement in soil may result in:

- Some minerals in the soil becoming soluble and reaching toxic levels for plants
- Some minerals made more available to plants
- The reduction and/ or killing of some bacteria which are important for sustaining plant life
- The encouragement of some moulds

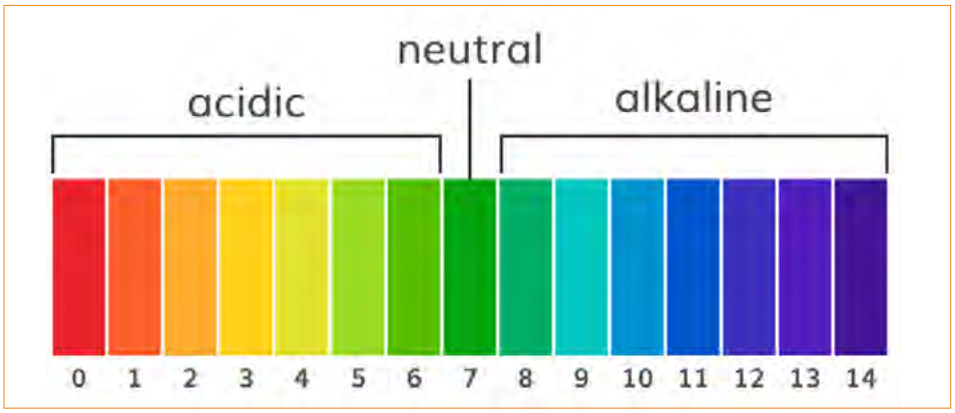
A high pH measurement in soil may result in:

- Some minerals being made unavailable to plants
- Some minerals becoming more available and possibly toxic to plants
- Discouragement of beneficial bacteria
- Favouring conditions for decay-causing bacteria

pH 6.5 – optimum for most plant growth; neutral soil conditions; some trace elements may become unavailable.

pH 5.5 – balance of major nutrients and trace elements available.

pH Scale



Materials

- pH test kit and/or a pH meter
- 2 different soil samples
- White plates

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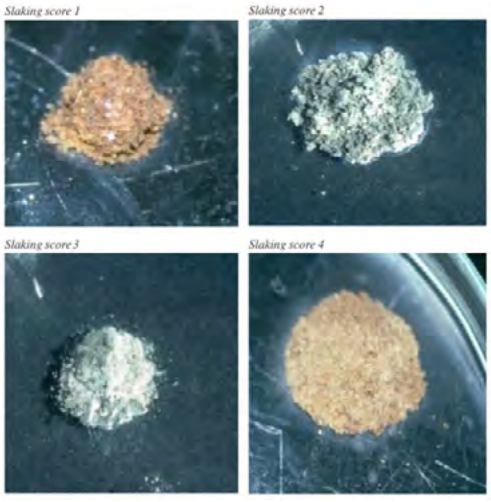
Presence of Organic Matter

Slaking

Slaking is the breakdown of a lump of soil into smaller fragments on wetting. It is caused when clay swells and the trapped air bursts out. Organic matter reduces slaking by binding mineral particles and by slowing the rate of wetting. This process occurs in all soil groups of the main vegetable-growing districts. The results can be either good or bad, depending on the size of the fragments produced. Slaking is involved in the process of self-mulching, which occurs in many cracking clays. Self-mulching produces a loose surface layer of granular aggregates. Sometimes a thin, fragile crust caps the layer, but the crust is not strong enough to affect seedling emergence. Crusting or hard setting soils slake into very small fragments that run together and then set hard on drying.

Dispersion

Dispersion (the separation of soil into single particles) is governed by soil texture, clay type, soil organic matter, soil salinity and exchangeable cations. Slaking and dispersion are soil characteristics that will have a considerable influence on the behaviour and management of a soil. A soil that disperses on wetting has a very unstable structure. It can form a surface crust or hard clods on drying. Pores below the surface can become blocked by dispersed soil particles. Dispersive soil is likely to swell strongly when wet, further restricting water and air movement. Dispersion of soil slows down the intake of water to the root zone following rainfall or irrigation. This condition will result in poor water storage at each irrigation.



Slaking Scores

0 Lump remains intact.

1 Aggregate slumps around the edges but remains mostly intact.

2 Aggregate breaks into clumps 2mm or bigger.

3 Aggregate breaks into clumps less than 2mm. Lump may begin to resemble a cone or volcano shape.

4 Aggregate breaks into individual particles or grains.

Slaking Test

1. Take a small aggregate of soil, roughly as big as a marble.
2. Place it carefully in a dish of water.
3. Watch to see what happens.
4. If small bubbles appear in the water and the lump collapses, your lump has slaked. This means it has no decayed organic matter keeping it together.
5. When soil slakes, water rushes into the air pockets in the soil, forcing air out as bubbles. This explodes the soil aggregate. Slaking occurs when soil is cultivated without organic matter going into the soil.
6. If nothing happens, your soil has organic matter and is structurally sound.

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How Do We Interpret This?

Score of:

1 Soil is stable to wetting, probably due to the presence of organic matter.
2 Soil is stable to wetting, probably due to the presence of organic matter.
3 This is a score typical of self-mulching soils.
4 Soil contains low amount of organic matter. Soil may have surface crust or be hard setting. Very Dispersive Soil.
5 Soil contains low amount of organic matter. Soil may have surface crust or be hard setting. Very Dispersive Soil.

Based on your Findings (No more than a paragraph for each question)

What are the primary differences between your two soil samples (use your results from the table).

Based on these differences – Identify the qualities of a fertile soil.

Recommend some ways our agriculture students could improve the quality of the Ag farm soil.

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RESULTS

SOIL SOURCE	NOTES	SOIL TYPE (Chart A)	SOIL TYPE (Chart B)	SOIL TYPE (Student assessment)	pH TEST	SLAKING TEST
Ag farm and other (please specify location)	Gritty, sticky and silky. Ribbon 2.5cm etc	Clay/ Sand/ Loam	Clay/ Sand/ Loam	Judgement based on results of both soil type tests.	pH 4.5. Acidic Soil etc	10 mins – 1 hour – Overnight –
Ag Farm						10 mins – 1 hour – Overnight –
Other: Please specify location.						10 mins – 1 hour – Overnight –