How to measure your own soil health

Farmer’s toolbox

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Why Soil Health Matters

Healthy soils support productive, efficient and resilient farming systems.

1

PRODUCTIVITY

Supports crop and pasture growth

2

NUTRIENT CYCLING

Releases and retains plant nutrients

3

WATER REGULATION

Improves infiltration and storage

4

BIODIVERSITY

Sustains microbes and soil fauna

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Farmer’s Toolbox Overview

01. Compaction

02. Water infiltration

03. Microbial activity

04. Earthworm counting

05. pH & NPK

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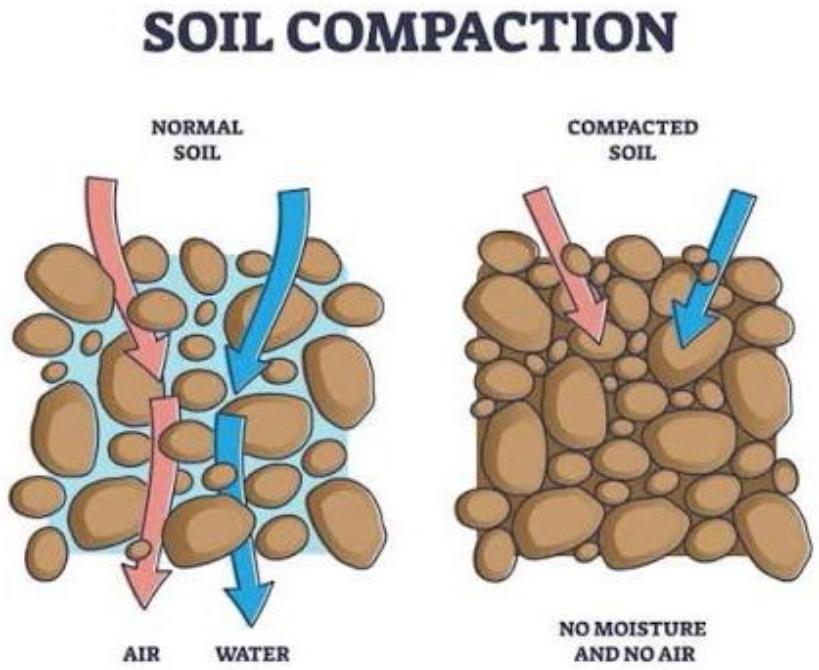
Use the same locations and similar field conditions when comparing results over time.

Soil Compaction

Recognise the causes, diagnose field signs and measure resistance at the right soil moisture.



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What is Soil Compaction

Pressure compresses soil particles, damages aggregates and reduces pore space.

Less pore space

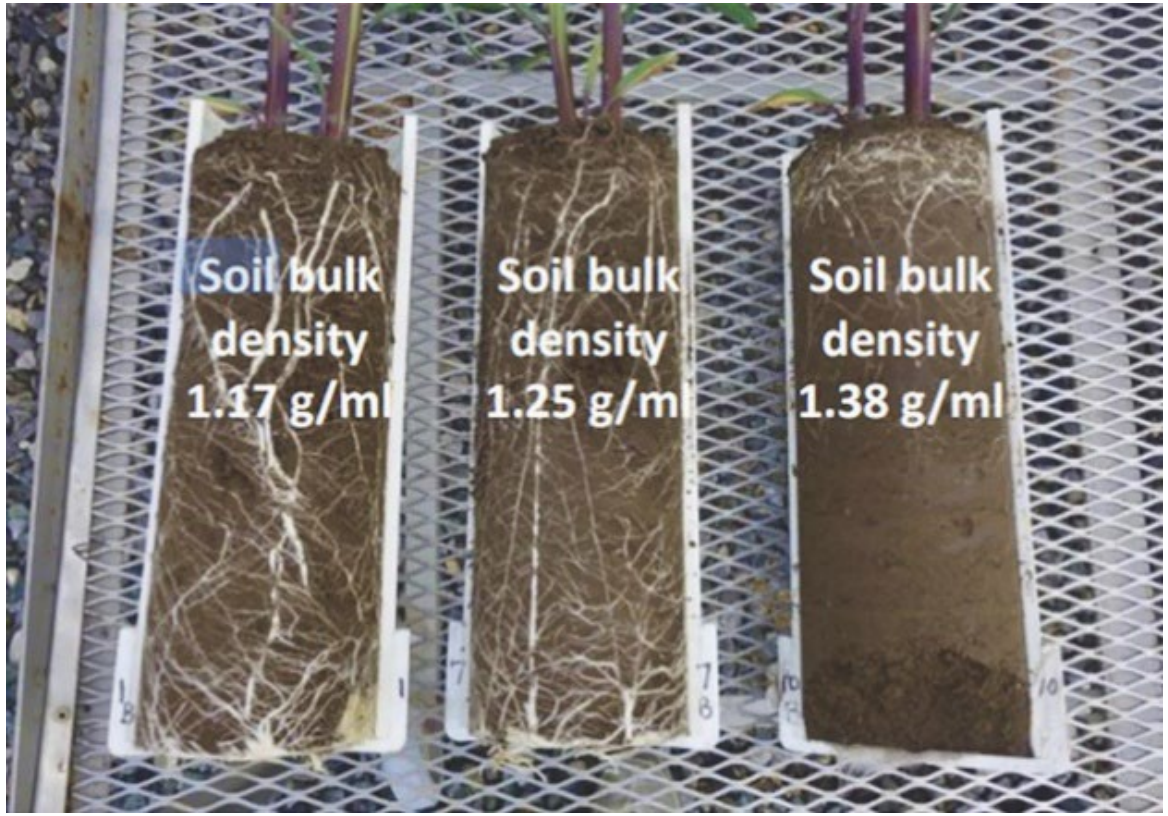
Reduced movement of air and water

Restricted roots

Shallow or sideways root growth

Denser soil

Greater resistance to penetration



Healthy soil = sponge

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Causes and Effects

MAIN CAUSES

Heavy machinery
Livestock trampling
Cultivation and repeated trafficking
Working soil in wet conditions

FIELD EFFECTS

Waterlogging and runoff
Poor aeration
Reduced biological activity
Restricted nutrient uptake
Lower crop or pasture performance

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Visual Diagnosis

Look above and below ground before using a mechanical test.

SURFACE SIGNS

Water pooling • Runoff rills • Patchy growth • Hard ground

BELOW GROUND

Sideways roots • Platy or blocky structure • Grey/orange mottling • Few earthworms • Sudden digging resistance

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Penetrometer Assessment

Test close to field capacity and take multiple readings across representative areas.

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Penetrometer Assessment

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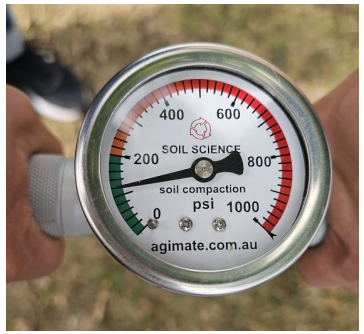

GREEN

0–150 psi

No restriction

YELLOW

150–300 psi

Moderate restriction

RED

300+ psi

Severe restriction

Important: resistance is strongly affected by soil moisture and texture. Compare like with like.

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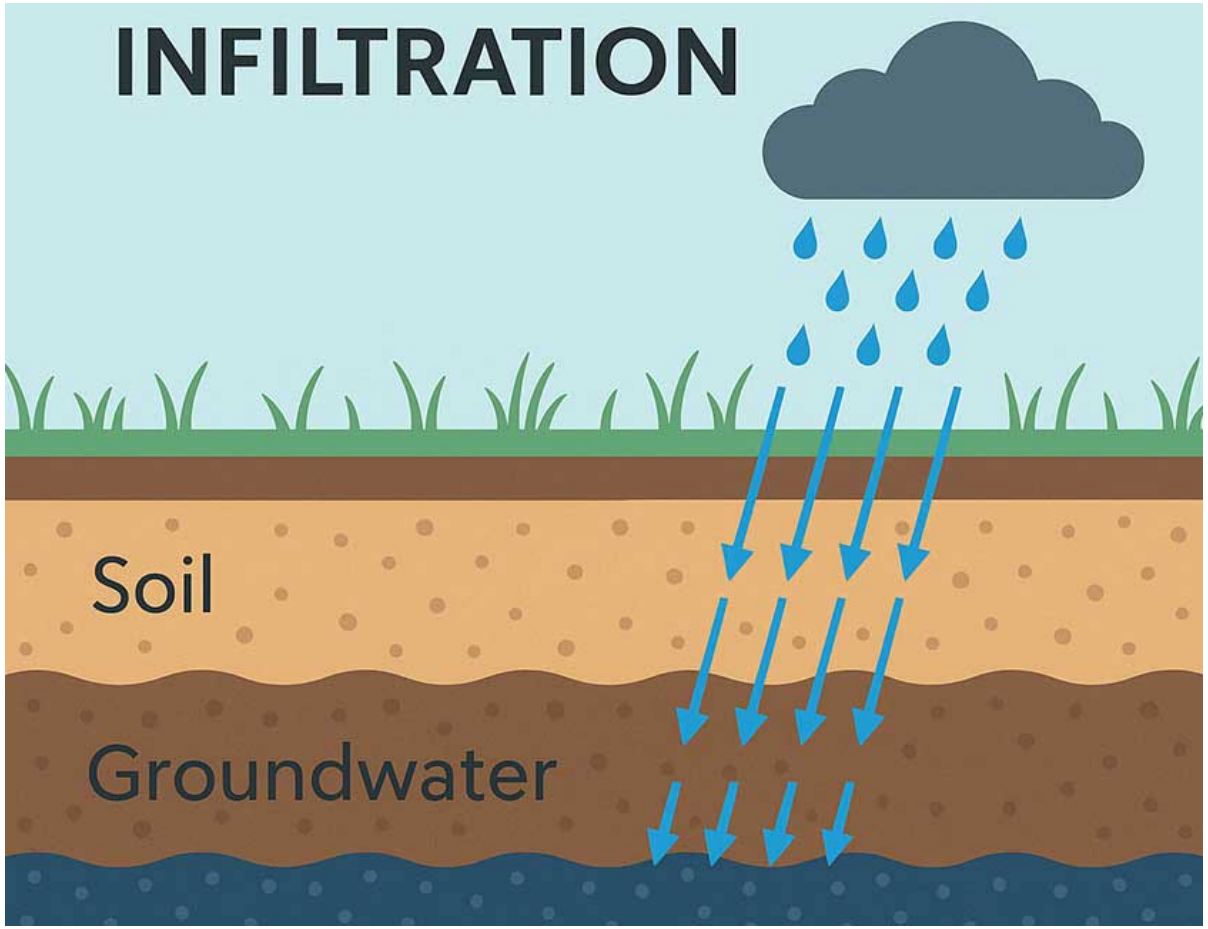
Water Infiltration

Measure how quickly rainfall enters the soil and compare fields with similar soil texture.



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Why measure water infiltration?

RAINFALL

reaches the surface

INFILTRATION

enters soil pores

STORAGE

is held in the profile

CROP USE

supports growth

Faster infiltration generally indicates better porosity, structure and biological activity.

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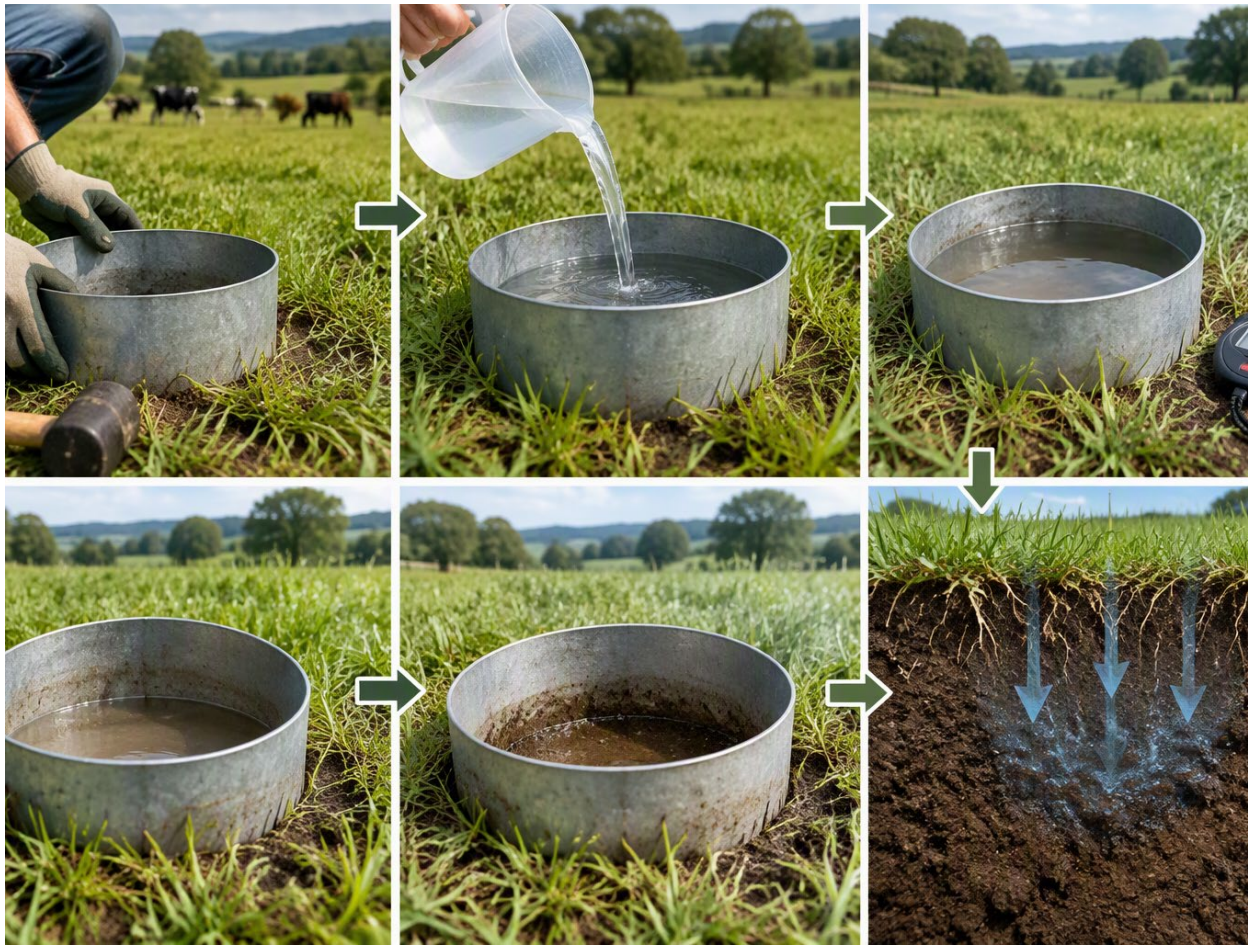
Infiltration Test Methods

A simple ring test provides a repeatable field comparison.



1. Insert the ring about 3 cm
2. Add water to 2.5 cm depth
3. Start the stopwatch
4. Stop when surface water disappears
5. Repeat if soil was initially dry

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Interpretation by soil type

Use these rates as a guideline, not as fixed pass/fail thresholds.

SOIL TYPE	INFILTRATION RATE (mm/hour)
Sand	>30
Sandy loam	20–30
Loam	10–20
Clay loam	5–10
Clay	1–5

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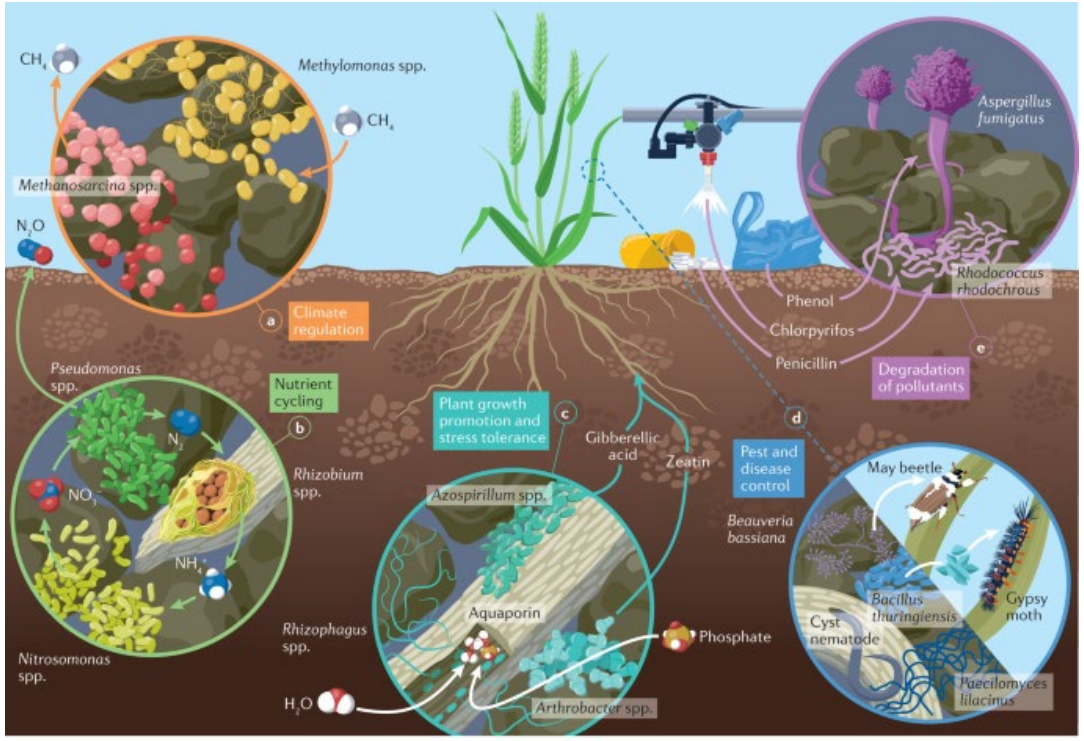
Soil microbial activity

Use cotton decomposition as an accessible indicator of biological activity in the root zone.



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Why soil microbes matter

DECOMPOSITION

Break down residues and organic materials

NUTRIENT CYCLING

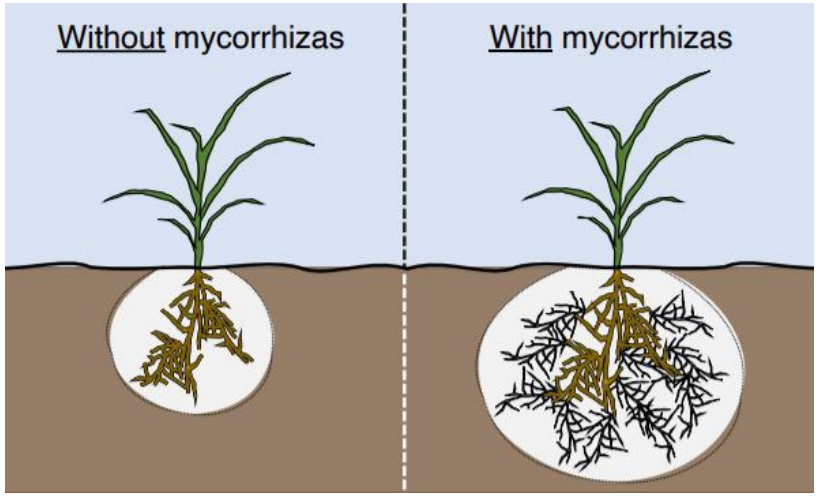
Convert nutrients into plant-available forms

HUMUS FORMATION

Help create stable organic matter and aggregates

SYMBIOSIS

Support roots through fungi and bacteria



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Cotton strip test

Cellulose becomes a “food source” for active soil organisms.

1 Bury

Lay untreated 100% cotton flat at about 15 cm depth.

2 Wait

Leave in place for six weeks during warm, active conditions.

3 Retrieve

Excavate carefully, rinse gently and allow to dry.

100% untreated cotton (i.e., Unbleached Calico, t-shit, underpant)

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Cotton strip interpretation

EXCELLENT	GOOD	POOR
Almost nothing remains	**Holes, shredding and thinning**	**Mostly intact and stained**
Very high biological activity	Moderate to high activity	Low biological activity

For reliable comparisons, use several strips and include an undisturbed hedgerow reference.

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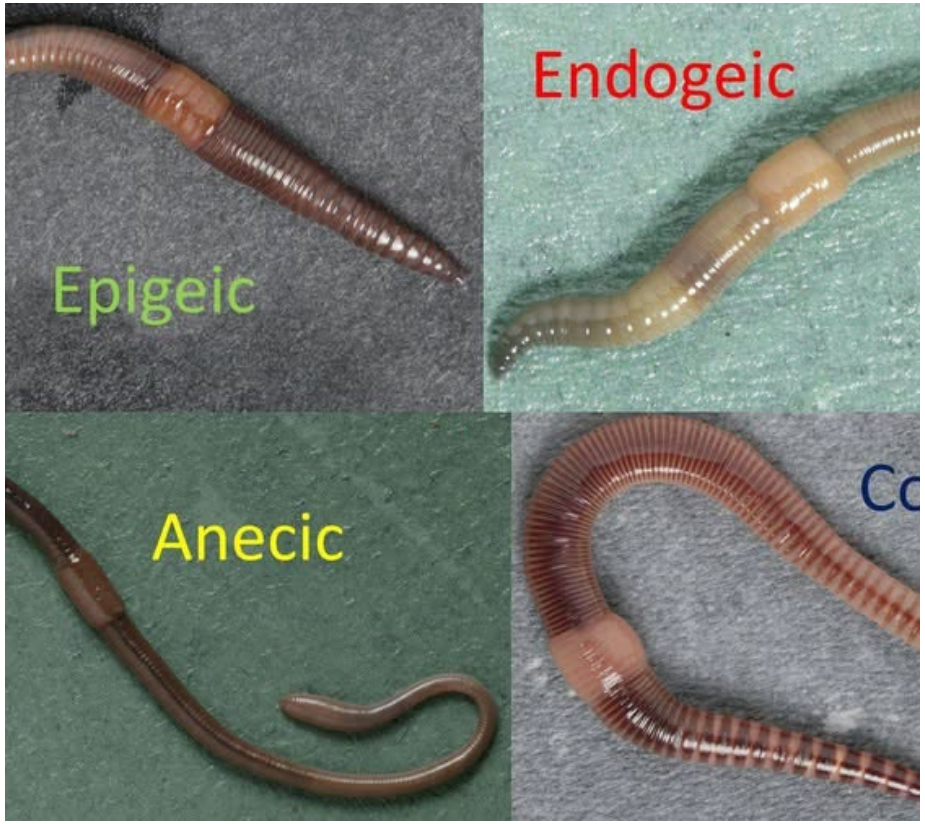
Earthworm counting

Count earthworms as visible indicators of aeration, drainage, decomposition and nutrient cycling



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Earthworms as soil engineers

AERATION

Burrows create pathways for air and roots

DRAINAGE

Channels improve movement of rainfall

ORGANIC MATTER

Residues are mixed into the soil

NUTRIENTS

Castings concentrate available nutrients

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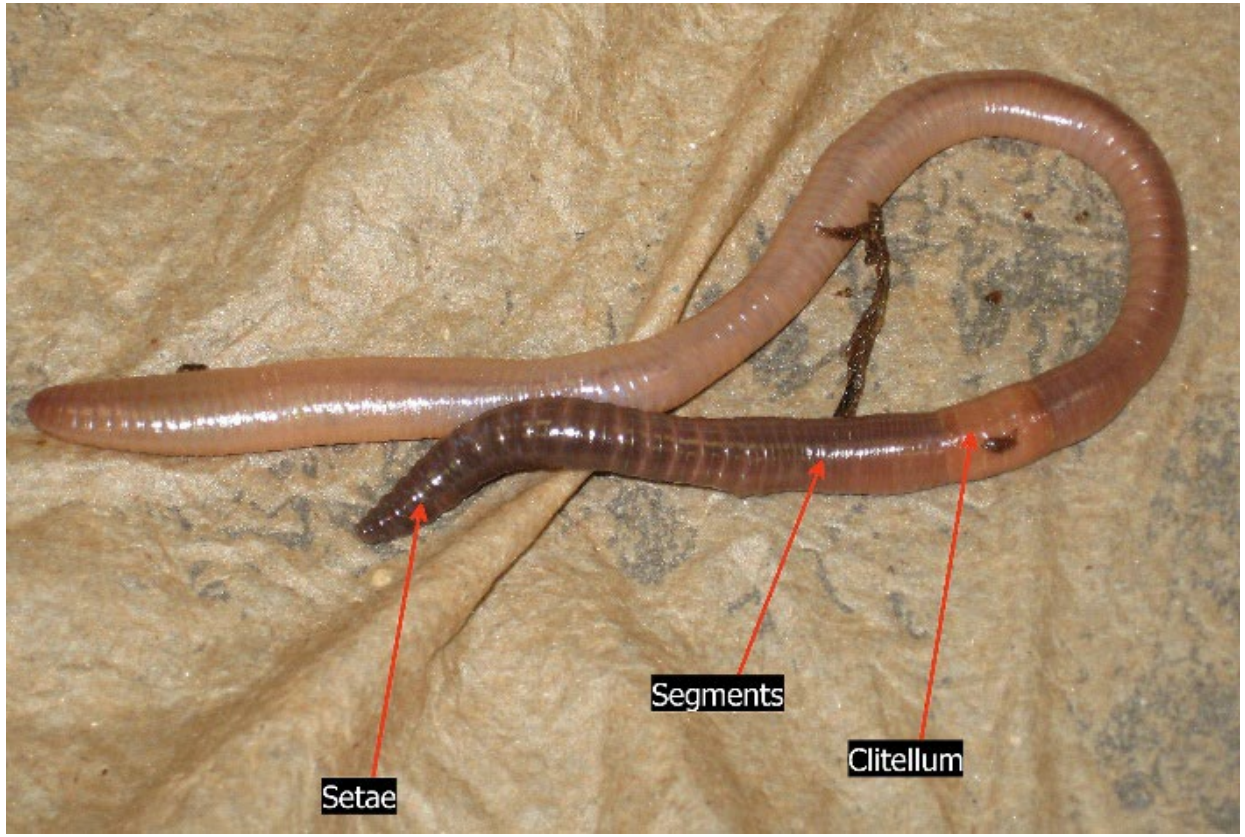
Earthworms: adult and juvenile

To determine the maturity of the earthworms that you found in your soil, look for the **saddle (clitellum).**

- Adult earthworms have a developed ‘saddle’ (clitellum). This is a unique, raised band located near the head end of the worm, which is part of its reproductive system.

- Juveniles: will not have this raised band. Their bodies are completely smooth from head to tail.



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Earthworm Ecological groups

EPIGEIC

HABITAT	Surface litter
COLOUR	Red pigmented
ROLE	Organic matter breakdown

ENDOGEIC

HABITAT	Upper mineral soil
COLOUR	Pale grey, pink or green
ROLE	Aggregation and mineralisation

ANECIC

HABITAT	Deep vertical burrows
COLOUR	Large, darker head
ROLE	Drainage and root penetration

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Earthworm counting protocol

1

DIG

Remove a 20 × 20 × 20 cm soil block

2

SORT

Hand-sort gently on a tray or mat

3

COUNT

Separate adults and juveniles

4

RECORD

Note totals and return soil and worms

Best timing: moist, warm soil in spring or autumn, not immediately after intense rainfall.

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Earthworm counting protocol

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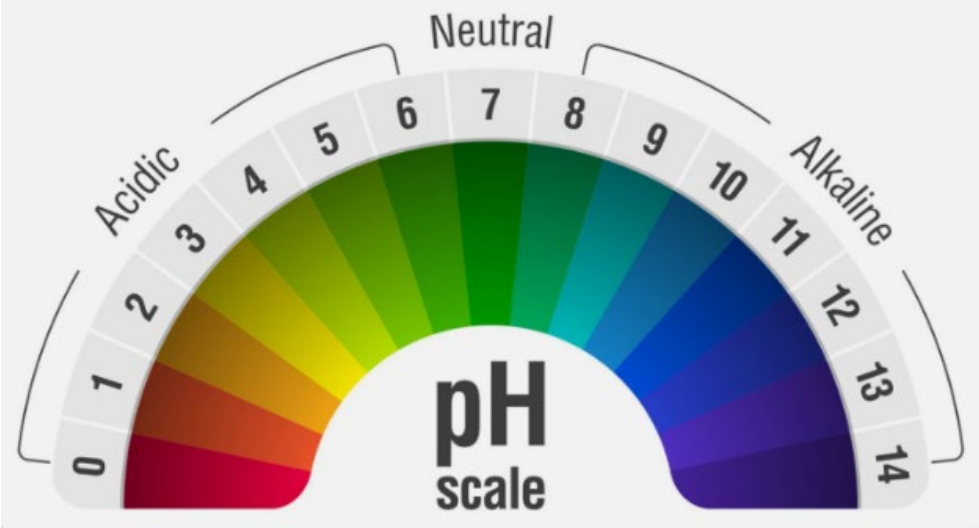
Soil pH

Soil pH is a measure of how acidic or alkaline your soil is. The pH scale ranges from 0 to 14



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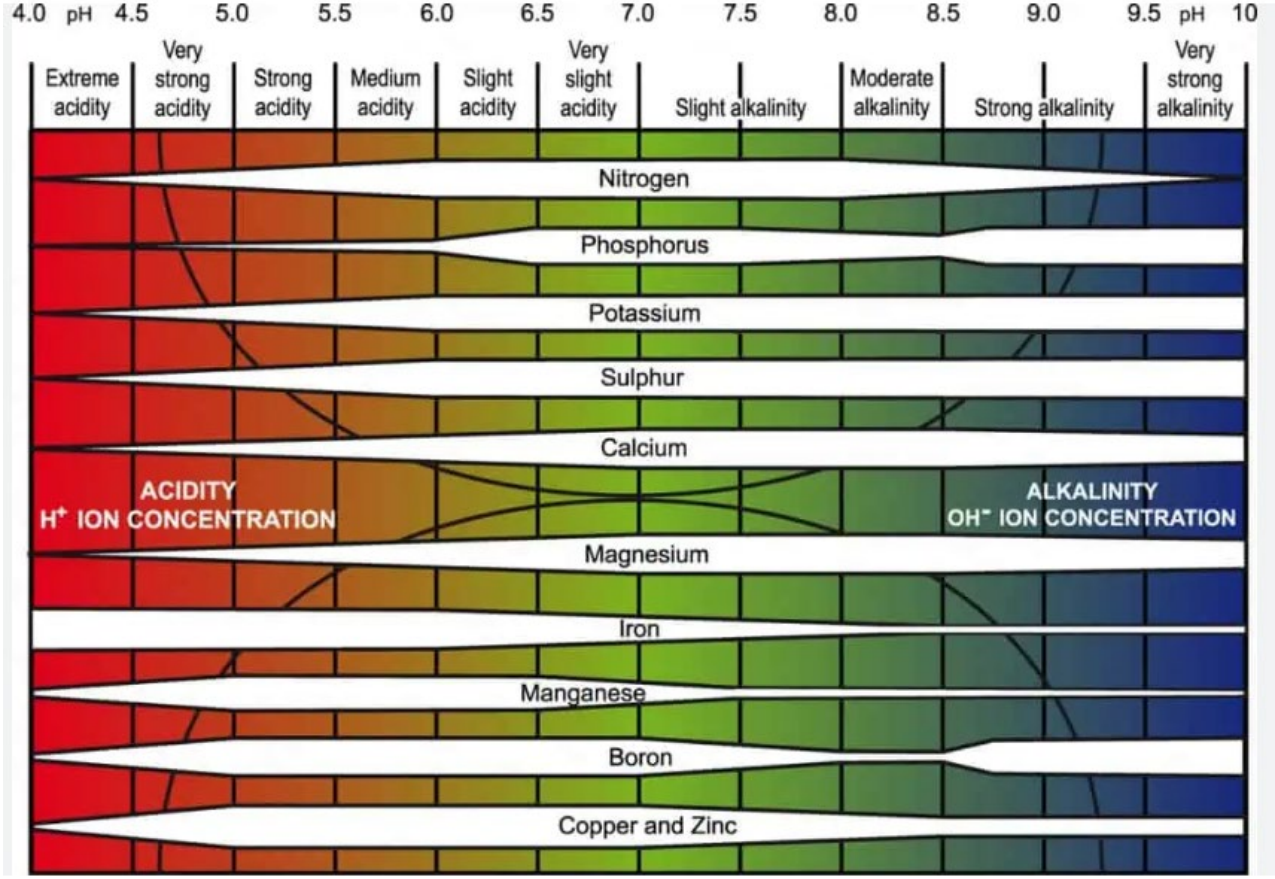
Why is soil pH important

- Roots grow more efficiently to absorb moisture and nutrients
- Plants develop stronger immune systems and resilience to weather and disease stress
- Fertilisers are used more effectively, minimising input costs and waste
- Crop yields and overall quality can improve



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When to measure pH

Soil pH can be measured at any time of the year, but it's best to mean your soil pH before planting and before fertiliser applications. This provides an accurate picture of the soil's initial condition. For consistency, it is recommended to sample at approximately the same time each year and under similar soil moisture conditions. Avoid measuring pH when soils are extremely dry or waterlogged, as these conditions can make sampling more difficult.

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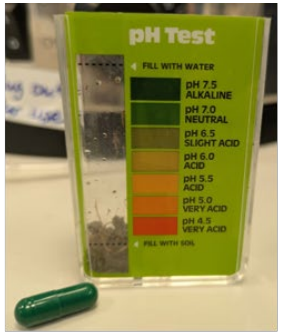
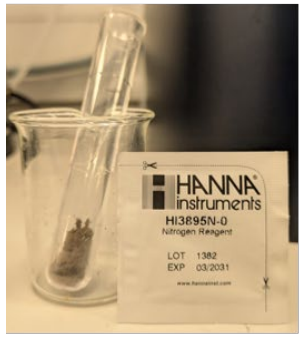
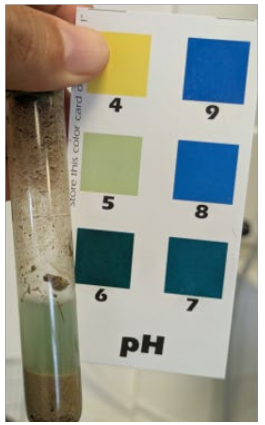
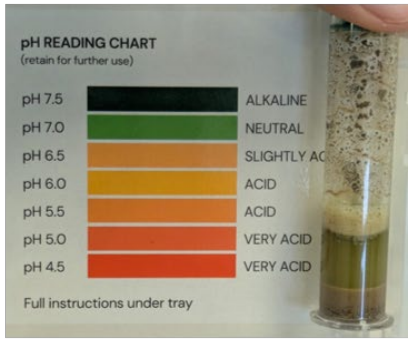
How to measure pH

- Depending on the soil test kit, remove the cap from the box or test tube.
- Fill the box or test tube with soil to the recommended level, approximately the amount equivalent to half a teaspoon.
- Carefully add the full content of the pH reagent(s) to the soil sample in the box or test tube.
- Using a dropper (usually provided in the kit), add bottled water to the water fill line.
- Cap the box or test tube. Make sure it is sealed properly and shake thoroughly.
- Allow soil to settle and colour to develop. Depending on the kit, this can take up to 5 minutes.
- Compare the colour of the solution to the pH chart provided with the kit.









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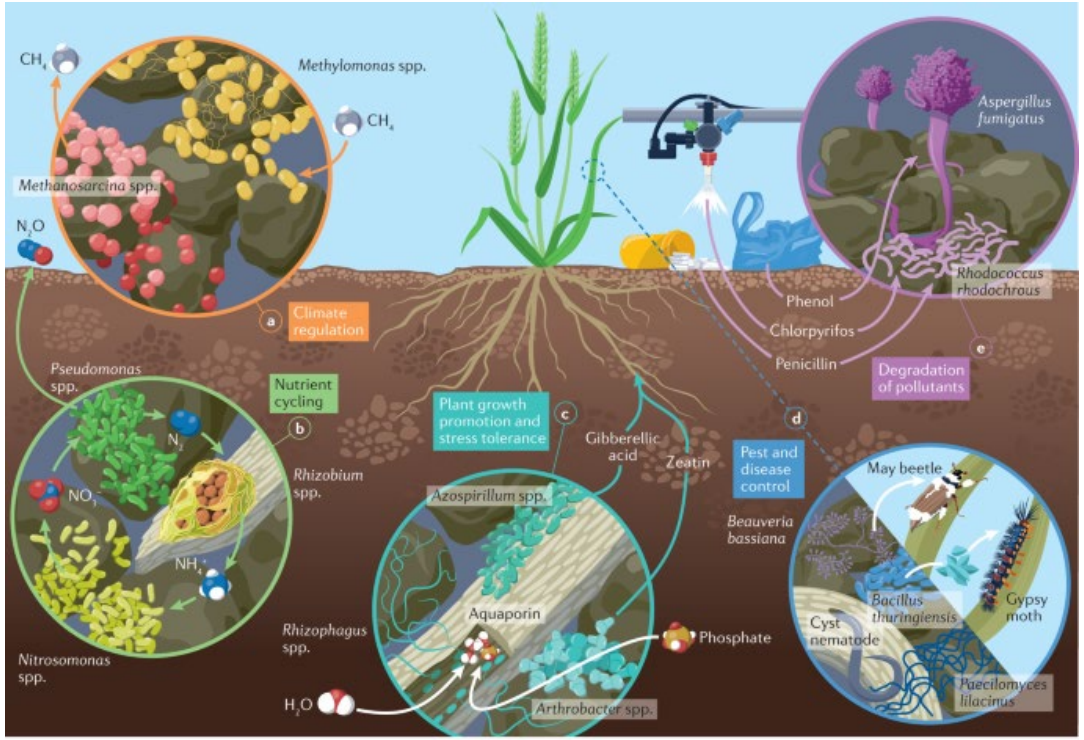
Soil NPK

Nitrogen (N), phosphorus (P) and potassium (K) are the three primary nutrients required by plants to grow and are commonly supplied through fertilisers. Each nutrient plays a different role in plant development.



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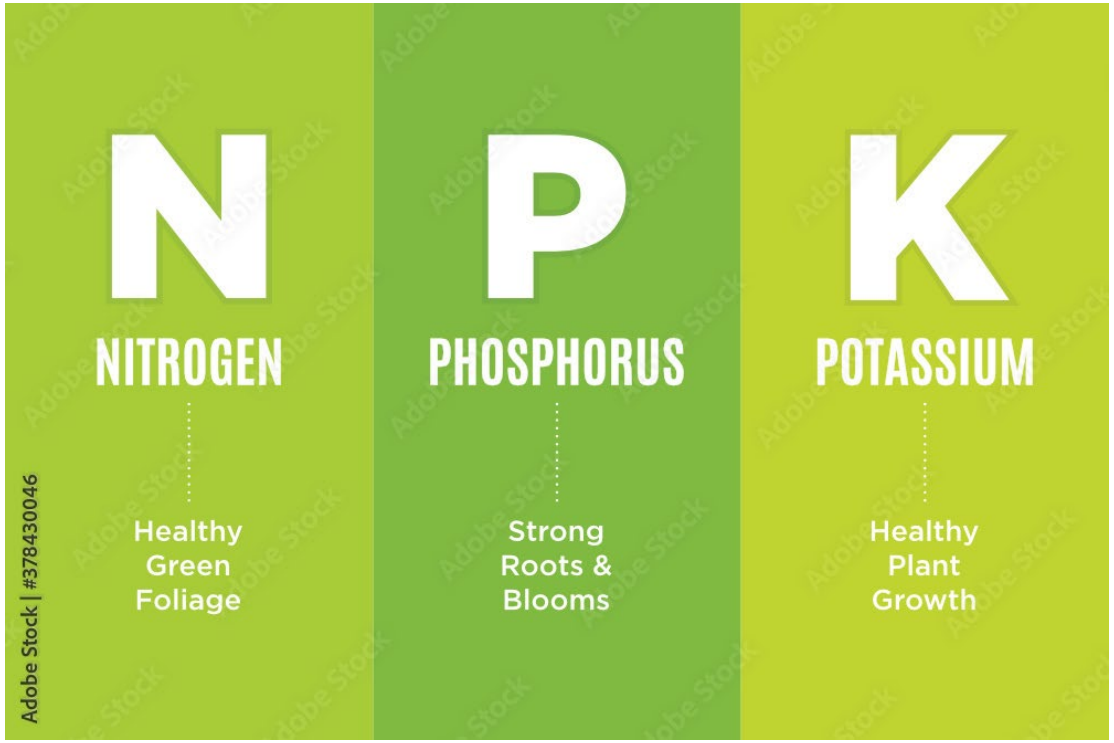
What is NPK, why they are important

- Nitrogen promotes leafy growth, supports chlorophyl production and gives plants a healthy green colour.
- Phosphorus is essential for proper root development, early plant establishment, and production of flowers and seeds.
- Potassium makes the plants resilient to stress by helping water regulation within the plant, improving resistance to drought, pests and diseases. A balanced supply of these nutrients is important for healthy plant growth and good crop yields.



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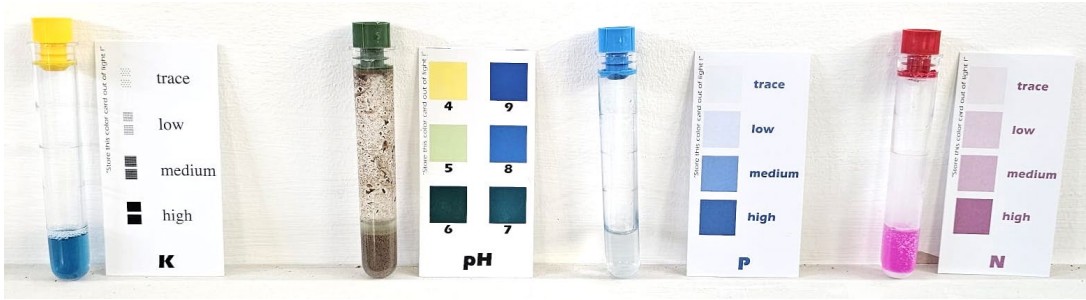
How to measure NPK

- Fill a clean container with 1 cup of soil and 5 cups of bottled water, or measure the ratio of soil and water is 1:5.
- Thoroughly shake or stir the soil and water together for one minute, then allow the mixture to settle for 1 to 24 hours, depending on the type of soil. Allowing the water to clear yields better results.
- Select the appropriate box or test tube for the test you wish to run, depending on the soil test kit.
- Use the dropper (usually provided by the soil test kits) fill the test chamber or test tube to the fill line with solution from the soil sample. Avoid disturbing sediment. Transfer only liquid.
- Carefully add the full content of the appropriate test reagent to the solution sample in the box or test tube.
- Cap the box or test tube. Make sure it is sealed properly and shake thoroughly.
- Allow Colour to develop. Depending on the kit and test, this can take up from 5 to 10 minutes.



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Healthy Soil, Resilient Farms

- ✓ Low compaction
- ✓ Good infiltration
- ✓ Active microbes
- ✓ Abundant earthworms
- ✓ Balanced pH & nutrients

Use simple, repeatable observations to guide better soil management decisions.

THANK YOU

https://soilcratesireland.ie/