Soils

Soil Characteristics

Physical

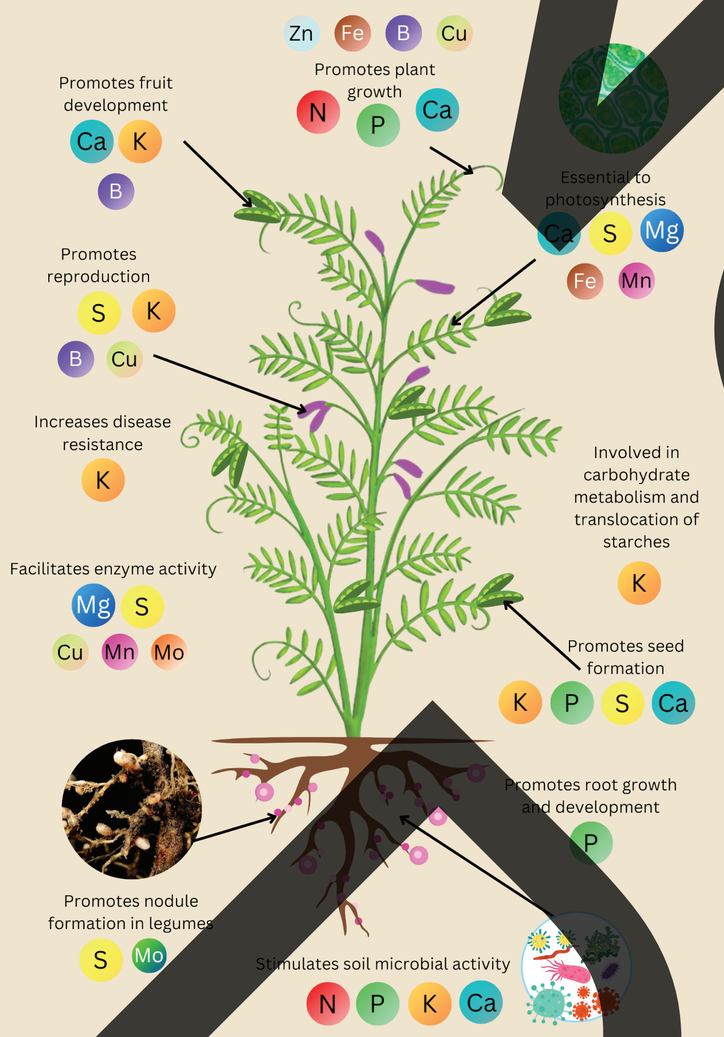
Biological

Chemical

Macro and trace nutrients

Essential nutrients are categorised as macronutrients or micronutrients (trace elements) and are essential for plant function, growth and development.

- **Macronutrients:** Nitrogen (N), Phosphorus (P) and Potassium (K), Calcium (Ca), Magnesium (Mg) and Sulfur (S)
- **Micronutrients:** Iron (Fe), Manganese (Mn), Zinc (Zn), Copper (Cu), Boron (B) and Molybdenum (Mo



Physical properties

Texture: proportion of sand:silt:clay (Practical: 'Ribbon' hand texturing test)

Structure: arrangement of soil particles (Practical: flow chart or slaking/dispersal)

Colour: indicates minerals, organic matter, waterlogging (Practical: determine soil colours)

Soil porosity: % = (Volume of water poured into soil sample ÷ Total sample volume) × 100

Bulk density: (g/cm3) = Dry soil mass (g) ÷ Soil volume (cm3)

Biological properties

Soil Organic Matter (SOM): all living, or once-living, materials within, or added to, the soil. Contains N, P, K, S, Mg, Ca, C etc

Soil Organic Carbon (SOC): a measurable component of SOM. C component only

Soil microbes: Macro, meso and micro-organisms. Essential for nutrient cycling and soil food web

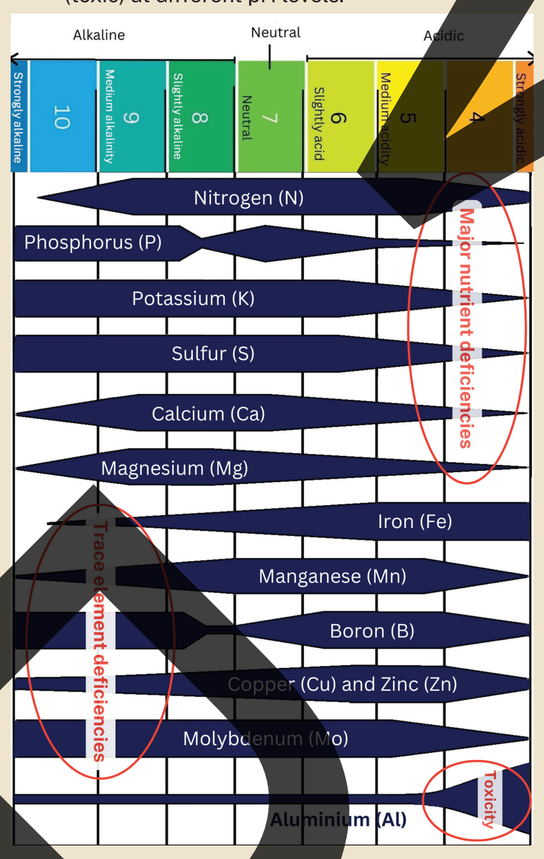
Chemical properties

pH: 1-14 Acidic/Neutral/Alkaline
(Field test: Barium sulfate and universal indicator)

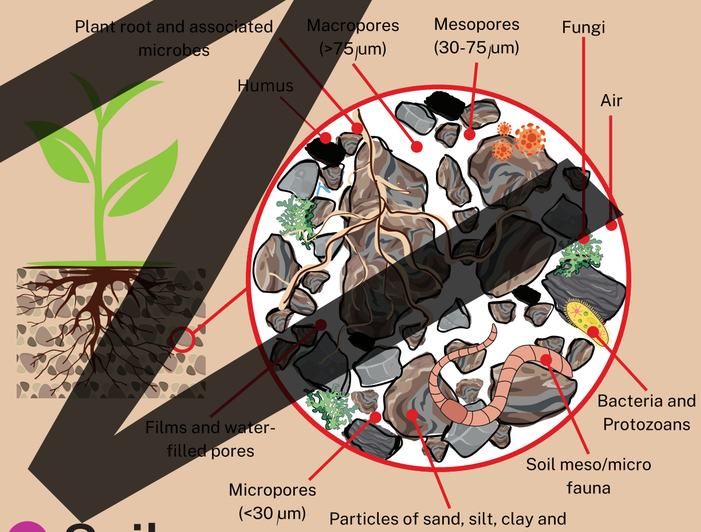
Ion Exchange capacity (IEC): influenced by organic matter and clay content.
CEC influences nutrient-holding ability and soil fertility

Soil nutrient status: macronutrients (N, P, K, S, Ca, Mg) and micronutrients (Fe, Mn, Cu, Zn, B, Mo)

Soil pH is the most limiting manageable soil factor in plant growth. A soil pH (CaCl2) between 5.5 and 7.0 is ideal for most agricultural plants. Different nutrients become unavailable (deficient) or oversupplied (toxic) at different pH levels.



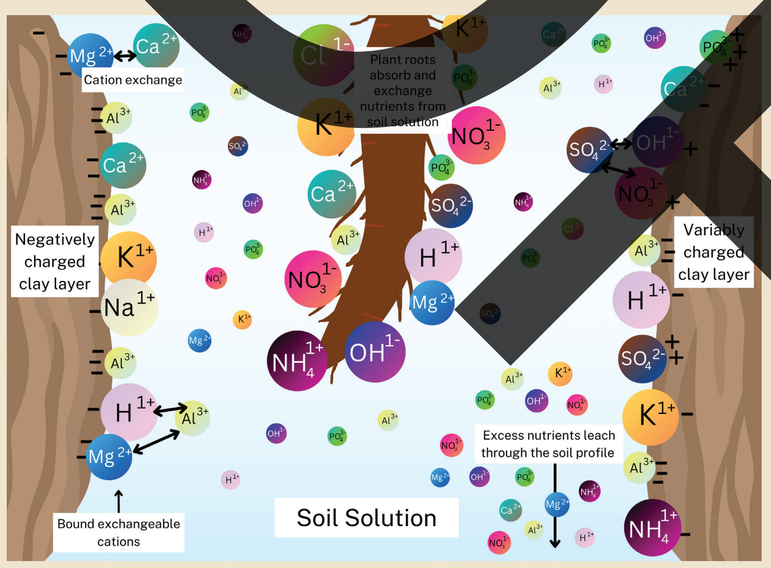
Soil structure How soil particles (sand, silt and clay) plus organic matter are arranged. Well structured soils have many small aggregates and soils pores for gas exchange and water storage.



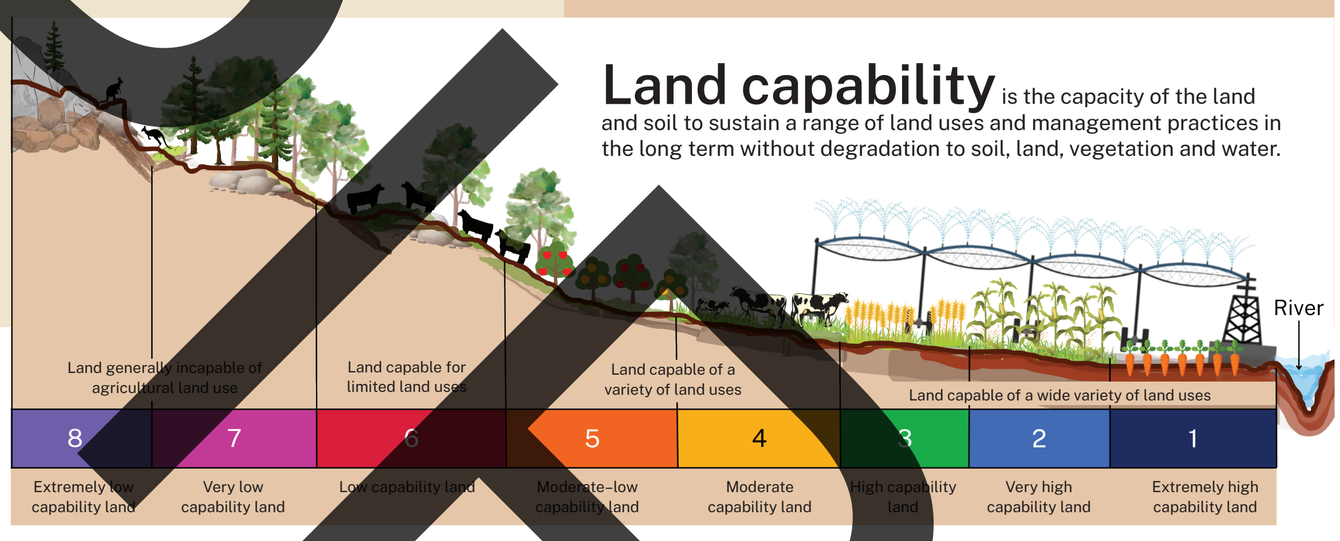
Soil texture

The proportion of sand: silt: clay. Measured in field using the 'ribboning test' and read using the texture triangle.

Ion Exchange Capacity is a measure of the soil's ability to hold positively or negatively charged ions. It influences soil fertility, soil structural stability, plant nutrient absorption, soil pH and the soil's nutrient holding potential. Clay soils and organic matter have a high -ve surface charge and high cation exchange capacity (CEC).



Land capability is the capacity of the land and soil to sustain a range of land uses and management practices in the long term without degradation to soil, land, vegetation and water.



Nutrient cycles Microbes and invertebrates are essential for nutrient cycling. They ensure nutrients are recycled and made available to plants, which are the foundation of food chains, ecosystems and sustainable agricultural production.

Carbon Cycle

Nitrogen Cycle

Soil horizons

Soil horizons are distinctive physical features of a soil profile. Each horizon has characteristics such as colour, texture and structure that distinguish it from those lying above or beneath.

O Horizon:

- dominated by decomposing organic matter (e.g. leaves, needles, twigs, moss and lichens)
- 0 horizons are quite rare in Australian soils
- occur in alpine peat soils

A Horizon:

- natural surface layer
- darker colour than horizons below due to organic matter
- 90% of plant nutrients are supplied by the A Horizon
- most biologically active horizon
- weathering and leaching are evident

B Horizon:

- zone of accumulation of weathered/leached material
- made up mineral layers with high clay content and iron or aluminium hydroxides
- colours are brighter than the A horizon

C Horizon:

- layers beneath the A and B horizons
- contain partly altered and weathered parent material, along with clay minerals

R Horizon:

- consists of hard bedrock (parent material)
- bedrock may contain very small cracks, impenetrable by plant roots

Produced by the Department of Primary Industries and Regional Development

To see more posters and workbooks in the Industry Insights series scan the QR code or visit our website

Australian Government

This project has been supported by the Australian Government through funding to implement the National Soil Action Plan.

www.dpird.nsw.gov.au

18739-3/25