



**A Horizon:** Upper most soil horizon, containing greatest amount of organic matter, giving it a characteristic dark colour and least amount of mineral matter. Typically 5-15 cm deep. See B horizon.

**absorption:** Uptake of matter or energy by a substance. Contrast with adsorption.

**acidic:** Soils with a pH less than 5.5 in water, in contrast to neutral or alkaline soils. Soils with pH less than 4.5 are considered very acidic. Contrast with alkaline and neutral soils.

**acidification:** The process whereby soils become acidic over time as a result of: the parent material; the addition of nitrogen to the soil by either fertiliser or legumes (where nitrogen is converted to nitrate); and/or the leaching of cations down the soil profile by rainfall.

**adsorption:** The process by which atoms, molecules, or ions are taken up from the soil solution or soil atmosphere and retained (**adsorbed**) on the surfaces of solids by chemical or physical binding. Contrast with absorption.

**aggregate:** A group of primary soil particles that cohere to each other more strongly than to other surrounding particles. Also called "crumbs".

**alkaline:** Soils with a pH greater than 7.5 in water. Contrast with acidic and neutral soils.

**anions:** Negatively charged ions, eg nitrate, chloride, phosphate. Contrast with cations.

**apedal:** Soils in which pedes are not visible when the soil is moderately moist.

**B Horizon:** Beneath A horizon, containing greatest amount of mineral matter, it usually has the greatest concentration of clay particles and nutrients.

**bulk density:** A measure of the suitability of the soil for plant growth. Soils with low bulk densities are more suitable because they are better aerated, are easier for roots to grow through and allow faster flow of water. It is the amount of soil material per unit of volume in an undisturbed sample of soil and values typically range between 1 and 2 t per cubic metre.

**cation-exchange capacity:** A measure of the soil's ability to adsorb and exchange cations and nutrients. It represents the total negative charge per unit quantity of soil.

**cations:** Positively charged ions, eg sodium, potassium, zinc. Contrast with anions.

**calcareous:** Soil material with at least 5% limestone or carbonate.

**calcarosols:** Soils with limestone as a major component of the soil material (normally regarded as having at least 5% in the surface layer(s). Do not have distinct or abrupt changes between horizon layers. Includes the mallee soils.

**chromosols:** Soils whose essential feature is a strong texture contrast between the A and B horizons. They are distinguished from other texture contrast soils by not being strongly acidic or sodic in their upper B horizons. Includes the red brown earths.

**clay:** (i) Soil particles <0.002 mm in diameter (generally the smallest particles in the soil), or (ii) A classification of soil.

**clod:** A compact, coherent mass of soil varying in size, usually produced by ploughing, digging, etc., especially when these operations are performed on soils that are either too wet or too dry and usually formed by compression, or breaking off from a larger unit, as opposed to a building-up action as in aggregation (also see ped).

**compaction:** The process where soil density is increased as a result of tillage, stock trampling and/or vehicular trafficking. Compaction can lead to lower soil permeability, poorer soil aeration resulting in increased erosion hazard and poorer plant productivity. Deep ripping and conservation tillage can alleviate the condition.

**cone penetrometer:** See penetrometer.

**constraint:** Any property of the soil within the root zone which prevents the crop or pasture from making the best use of the light, air, temperature and rainfall. Includes physical (eg hard pan, bed rock), chemical (salinity, boron toxicity or infertility) and biological (eg root diseases, lack of suitable rhizobia) properties.

**controlled traffic:** A farming system in which the wheel tracks of all operations are confined to fixed paths so that re-compaction of soil by traffic (traction or transport) does not occur outside the selected paths.

**deep ripping:** Cultivation operation which is conducted to physically disrupt compacted layers in the soil. Normally conducted with specialised equipment in a separate operation, with wide rows (ie wider than seeding rows) and to depths greater than 20 cm. Compare to deep tillage.

**deep tillage/ploughing:** Is designed to break up plough pans and to provide a loose bed below the crop row. Normally conducted with modified seeding equipment during the seeding operation but can also be conducted in a pass prior to seeding. The modifications to the seeding equipment are normally high break-out pressure tines and deep working points. Depth of tillage is normally less than 20 cm. Contrasts with deep ripping.

**dispersible soils:** Soils that are structurally unstable and disperse in water into basic particles i.e. sand, silt and clay. Dispersible soils tend to be highly erodible and present problems for earth works. Sodicty will cause dispersion of soils. See sodicty.

**dispersion:** Process resulting from soil aggregate breakdown in water, leaving clay particles forming a cloud around the aggregate. See slaking.

**duplex:** Soils with layers which are distinctly different, easily discernible and change abruptly, eg sand over clay.

**Electromagnetic induction surveying:** Electromagnetic induction (EMI) sensing is a well-established geophysics technique that relies on electromagnetic pulses to indirectly sense the salt loads within a soil. Most commonly known as EM. The most common form in agriculture is EM38 which registers salt loads within 1.5 m of the surface.

**electrical conductivity (EC):** Is a measure of the conduction of electricity through water, or a water extract of soil. The value can reflect the amount of soluble salts in an extract and therefore provide an indication of soil salinity. It can be interpreted in terms of the salinity tolerance of plants but soil texture needs to be considered in this interpretation.

**exchangeable anion:** A negatively charged ion held on or near the surface of a solid particle by a positive surface charge and which may be easily replaced by other negatively charged ions ( eg with a Cl<sup>-</sup> salt). These ions are available to crops and pastures.

**exchangeable cation:** A positively charged ion held on or near the surface of a solid particle by a negative surface and which may be replaced by other positively charged ions in the soil solution. These ions are available to crops and pastures.

**exchangeable sodium percentage (ESP):** Is calculated as the proportion of the cation exchange capacity occupied by sodium ions and is expressed as a percentage. Sodic soils are categorised as soils with an ESP of 6-14%, and strongly sodic soils have an ESP of greater than 15% (see sodicty).

**field capacity (field moisture capacity):** The percentage of moisture remaining in a soil horizon 2-3 days after being completely saturated (by rainfall or irrigation) and after free drainage has ceased. Defined in the laboratory as the soil moisture at a suction pressure of -10 kPa (or -33 kPa in USA). Similar to upper storage limit.

**fixation:** Processes whereby available nutrients are trapped, adsorped or precipitated (**fixed**) by soil constituents. This will decrease the availability of the nutrient.

**flocculation:** The coagulation of colloidal soil particles due to the ions in solution. In most soils the clays and humic substances remain flocculated due to the presence of doubly and triply charged cations.

**gravimetric water content:** The amount of water present in soil which is measured by subtracting the oven dry weight of a soil sample from the original wet weight of the same sample. Expressed as g water per g of soil. Also known as the total water content.

**gypsum:** A naturally occurring soft crystalline material which is a hydrated form of calcium sulphate. Deposits occur naturally in inland Australia. Gypsum contains approximately 23% calcium and 18% sulphur. It is used to improve soil structure and reduce crusting in hard setting clayey soils.

**hardpan:** A soil layer with physical characteristics that limit root penetration and restrict water movement. Often also called a plough pan.

**hardsetting:** The condition of a dry surface which is compact and hard with no apparent pedal development. These soils are not disturbed by pressure of a finger. These harder setting soils tend to result in high runoff and poor seedling emergence.

**horizons:** The different layers within a soil type.

**infiltration:** The movement of water through the soil surface. Soils with a high infiltration capacity allow more rain to enter the soil than soils with a low capacity. Runoff will occur when the rate of rainfall exceeds the soil's infiltration capacity. Surface soil structure and texture and vegetative cover are important determinants of the infiltration capacity of a soil.

**ions:** Atoms, groups of atoms, or compounds, which are electrically charged as a result of the loss of electrons (cations) or the gain of electrons (anions).

**industrial salinity:** Salinity resulting from the application of waste water that had a high salt concentration.

**leaching:** The removal in solution of soluble minerals and salts as water moves through the profile.

**lime:** A naturally occurring calcareous material ( $\text{CaCO}_3$ ) used to raise the pH of an acidic soil.

**lower storage limit (LSL):** See permanent wilting point.

**macronutrient:** A nutrient required by plants in relatively high amounts. Usually refers to N, P, and K, but also includes Ca, Mg, and S.

**mallee soil:** See calcarosols.

**mass flow:** The movement of solutes associated with net movement of water.

**micronutrient:** A nutrient required by plants in relatively small amounts. These are B, Cl, Cu, Fe, Mn, Mo, Ni, Co, and Zn.

**mottling:** Is the presence of more than one soil colour in a horizon. The soil may differ in colour either within peds or aggregates, or between them. Mottling occurs as blotches or streaks of subdominant colour throughout the main colour. Mottling is often an indication of poor profile drainage but may be caused by the weathering of parent material.

**mycorrhizae:** Are soil fungi which act as rootlets and increase the amount of nutrients (particularly phosphorus and zinc) available to plants. Following, excessive tillage and soil fumigation can cause mycorrhiza to die out. Some plants such as rapeseed do not need mycorrhizae and therefore the fungi tend to die out of the soil also. Plants growing with mycorrhizae are generally healthier and more resistant to root disease and root rot.

**neutral:** Soils with a pH less than 7.5 and greater than 5.5 in water. Contrast with acidic or alkaline soils.

**nutrient deficiency:** A low concentration of an essential element that reduces plant growth and prevents completion of the normal plant life cycle.

**ped:** The natural unit of soil structure formed by the soil's tendency to fracture along planes of weakness (in contrast with a clod, which is formed artificially).

**penetrometer:** An instrument in the form of a cylindrical rod with a cone-shaped tip designed for penetrating soil and for measuring the strength of the soil.

**permanent wilting point:** Defines the amount of water remaining in the soil when a plant wilts so severely that it will not respond to added water but is usually measured in a laboratory test which does not take account of crop differences and soil constraints (see crop lower limit). Defined as the soil moisture at a suction pressure of  $-1500$  kPa. Can also be called the lower storage limit (LSL).

**pH:** A measure of soil acidity and soil alkalinity on a scale of 0 (extremely acidic) to 14 (extremely alkaline), 7 being neutral. Gives an indication of the availability of plant nutrients and relates to the growth requirements of particular crops.

**plant available water capacity (PAWC):** The amount of soil water that can be extracted by the plant. Traditionally, it was defined as the difference in soil moisture content between the field capacity and the permanent wilting point. More recently however, it has been defined as the difference between the drained upper limit (or field capacity) and the plant lower limit (see plant lower limit). It is usually expressed as millimetres of plant-available water within the root zone.

**potential plant available water capacity (PAWC<sub>p</sub>):** The amount of soil water that a plant could extract from the soil **provided that there are no limitations eg. subsoil constraints.** In contrast to PAWC, PAWC<sub>p</sub> is defined as the difference in soil moisture content between the field capacity (or USL) and the permanent wilting point (or LSL).

**plant lower limit:** The amount of water remaining in the soil after the crop or pasture has fully matured. It can differ from the wilting point because it is usually measured in the field and takes account of issues such as crop type and soil constraints.

**podsol:** A sub group of duplex soils which have developed under high rainfall conditions. Typically have domed clay B horizons and are regularly waterlogged.

**pore-size distribution:** The volume fractions of the various size ranges of pores in a soil, expressed as percentages of the soil bulk volume (soil particles plus pores).

**porosity (soil):** The degree of pore space in a soil (i.e. the percentage of the total space between solid particles)

**profile, soil:** A vertical section of the soil through all its horizons and extending into the C horizon.

**red brown earth:** See chromosols.

**redox potential:** A measure of the reduction-oxidation potential of reactive soil components.

**root zone:** The maximum depth of the soil profile which is exploited by plant roots.

**salinity:** Is a measure of the total soluble salts in a soil. A saline soil is one with an accumulation of free salts at the soil surface and/or within the profile affecting plant growth and/or land use. It is generally attributed to changes in land use or natural changes in drainage or climate which affects the movement of water through the landscape. Salinity levels of soil or water can be tested using Electrical Conductivity.

**saturated soil paste:** A particular mixture of soil and water. At saturation, the soil paste glistens as it reflects light, flows slightly when the container is tipped, and the paste slides freely and cleanly from a spatula. This is sometimes used during testing of soils for salinity.

**slaking:** Is the breaking down of soil aggregates when immersed in water into smaller sized micro-aggregates. These aggregates may subsequently disperse. See dispersion.

**self-mulching soil:** A soil in which the surface layer becomes so well aggregated that it does not crust and seal under the impact of rain but instead serves as a surface mulch upon drying. See Vertosol.

**sodicity:** Is a measure of exchangeable sodium in relation to other exchangeable cations. It is expressed as the Exchangeable Sodium Percentage. A sodic soil contains sufficient exchangeable sodium to interfere with the growth of plants, including crops. See sodosol.

**soil:** The unconsolidated mineral or organic material

**sodosol:** A sodic soil contains sufficient exchangeable sodium to interfere with the growth of plants, including crops. A soil with an ESP greater than 6 is generally regarded as being a sodic soil in Australia. See sodicity.

**structure:** Describes the way in which soil particles are arranged to form soil peds.

**surface soil:** The uppermost part of the soil, ordinarily moved in tillage, or its equivalent in uncultivated soils and ranging in depth from 7 to 25 cm. Frequently designated as the plough layer, the *surface layer*, the *Ap layer*, or the *Ap horizon*.

**subsoil:** The B horizons and their subdivisions, excluding the C horizon (bed rock). Essentially, it is the soil below the surface layer (ie the layer normally reached through cultivation).

**surface crust:** Occurs in soils with a massive or weakly structured surface crust which is lighter in texture than the underlying pedal clay. This condition should not be confused with self-mulching behaviour. Can prevent emergence of plants and increase run-off of water.

**total water content:** See gravimetric water content.

**upper storage limit (USL):** The maximum amount of water a soil can hold after drainage has ceased. Similar to field capacity. Sometimes known as the upper drained limit.

**volumetric water content:** The amount of water present in soil which is measured by subtracting the oven dry weight of a soil sample from the original wet weight of the same sample but calculated on a volume of soil basis, rather than weight of soil basis. Expressed as g water per cubic centimetre of soil.

**vertisol (vertic):** A soil with a field texture of 35% or more clay which experiences significant shrinking and swelling resulting from drying and wetting. This often results in the development of features such as surface cracking and gilgai formation.

**weathering:** The breakdown and changes in rocks and sediments at or near the Earth's surface produced by biological, chemical, and physical agents or combinations of them.

## References and further reading

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