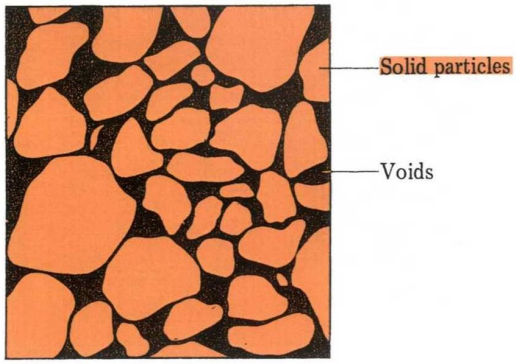
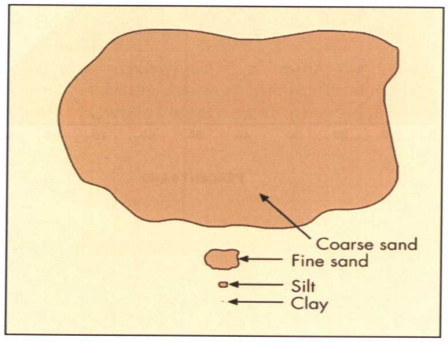
VOLUME WEIGHT

A sample of soil is usually extracted from its in-situ (natural state) in a paddock (or other sampling location) using a soil sampling tool, typically a sampling augur. The size of the sampling augur varies, but the end result is a core or column of soil of fixed dimensions. A number of individual samples are usually collected in this manner and these are then typically bulked up together into a larger sample which is then sent to the lab for analysis.

At the lab, the sample is air-dried at about 37°C overnight and ground to pass through a 2mm sieve prior to analysis. As part of the initial analysis, the Volume Weight of the sample is calculated. This parameter is derived by measuring the weight of a known volume of air-dried soil. Volume weight is simply another name for the dry bulk density of the sample. It is given this alternate name to avoid any confusion with another density parameter – Field Bulk Density.

A soil in its in-situ location comprises solid particles (inorganic soil minerals and organic matter) and voids (filled by either air or water). The weight of a known volume of air-dried soil will vary from one soil type to another, depending on the amount and type of inorganic and organic matter it contains, as well as its consistency or texture class (composition of sand, silt and clay) – cf diagrams below. Because it has been air-dried, it is assumed that most of the water has been removed.





The volume weight parameter thus gives an important indication about some of the soil physical parameters, particularly compaction, porosity etc. But more importantly, it also enables the results of lab soil analyses, which are often reported as weight measurements (mg/kg), to be converted to a unit area measurement (kg/ha), which can often be more helpful to primary producers.

In NZ, coarse textured sandy soils, which typically contain little organic matter, tend to have higher volume weights (> 1.0 g/mL). As soils develop, the volume weight reduces, typically to 0.7-0.8g/mL in sedimentary soils, which are becoming finer in texture as a result of soil processes and organic matter accumulation, and increasing porosity. Soils which have developed from lighter, less dense materials such as pumice or peat, generally have lower volume weights.

The main factors which influence volume weight are: pore space, texture and organic matter content. Any soil with a higher proportion of pore spaces to solids will have a lower volume weight than others which are more compact, and thus have less pore space. Any factor which affects soil pore space will also have an influence on the volume weight of that soil. Fine textured soils i.e. those which are made up of smaller sized particles (silt loams, clays/clay loams), generally have lower

volume weights than sandy soils. There are a couple of main reasons why a sandy soil has a higher volume weight, firstly, organic matter content is generally low, and secondly, the solid particles tend to be in closer proximity to each other than is commonly the case in fine textured soils. Conversely, as organic matter content increases and/or the size of the inorganic particles decreases, more voids develop within the soil, resulting in a lower volume weight.

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