Soil physical properties

Sand (%) = $100 - (\frac{(R_{40s} - R_L)}{Oven\ dried\ soil\ (g)}) \times 100$

Where R_L is the hydrometer reading in a solution containing 100 mL of Calgon® solution and 900 mL of distilled water and R_{40s} is the calibrated hydrometer reading in the suspension at 40s.

Clay (%) = $\frac{(R_{7h}\text{-}R_L)}{Oven\ dried\ soil\ (g)} \times 100$

Where R_L is the hydrometer reading in a solution containing 100 mL of Calgon® solution and 900 mL of distilled water; and R_{7h} is the calibrated hydrometer reading in the suspension at 7h.

Silt (%) = $100 - (\%\ sand + \%\ clay)$

Soil bulk density (BD) (Mg/m^3) = $\frac{M_s}{V_t}$

Where M_s is the mass of soil (Mg) obtained after oven drying; and V_t is the total volume (m^3) of the soil sample which is the volume of core sampler (includes soil solids, air and water). Vt is calculated from the dimensions (radius and height) of the cylindrical core by using the formula for volume of cylinder ($\pi r^2 h$).

Particle density (PD) (Mg/m^3) =$\frac{M_s}{V_s}$

Where M_s is the mass of soil (Mg) obtained after oven drying; and V_s is the volume (m^3) of the soil solids.

Vs is calculated using pycnometer. The formula used is Vs=(PYW-PY)-(PYSW-PYS). Here, PYW is the weight of pycnometer + hot water; PY is empty pycnometer weight; PYSW is the weight of pycnometer + soil + hot water; PYS is the weight of pycnometer + soil.

Total porosity (TP) (%) = $(1 - \frac{Bulk\ Density}{Particle\ Density}) \times 100$

Here, Bulk Density and Particle Density values comes from the calculations mentioned in their respective sections.

Gravimetric water content (GWC) (%) = $\frac{M_w}{M_s} \times 100$

Where M_w is the mass of moisture (g) calculated by subtracting the weight of oven dried soil sample (Ms) from fresh moist soil (FMs).

Volumetric water content (VWC) (% or cm^3/cm^3) = $(GWC \times BD)$

Where GWC is gravimetric water content (%); and BD is bulk density (Mg/m^3) and their values comes from the calculations mentioned in their respective sections.

Depth of soil water (DSW) (mm/cm or cm/m) = $(\frac{VWC}{100} \times SD)$

Where VWC is volumetric water content (%); and SD is the depth of soil profile layer taken for calculation. VWC values comes from the calculations mentioned in their respective sections.

Air filled porosity (AFP) (%) = $(Total\ porosity - Gravimetric\ water\ content)$

Here, Total Porosity and Gravimetric water content values comes from the calculations mentioned in their respective sections.

Water filled pore space (WFPS) (%) = $\frac{(\text{Soil water content }(\%) \times Bulk\ Density)}{(1 - \frac{Bulk\ Density}{Particle\ Density}) \times 2.65\ \text{Mg m}^{-3}}$

Here, Soil water content (also known as GWC) and Bulk Density values comes from the calculations mentioned in their respective sections.

Degree of saturation (DS) (%) $=\frac{VWC}{TP}$

Where VWC is volumetric water content (%); and TP is the total porosity (taken in decimals) whose values comes from the calculations mentioned in their respective sections.

Void ratio (VR) = $(\frac{TP}{1-TP})$

Where TP is the total porosity (taken in decimals by dividing percentage value by 100) whose values comes from the calculations mentioned in their respective sections.

Mean weight diameter (MWD) $= \sum_{i=1}^{n}(\bar{x}_i \times w_i)$

Where $\bar{x}_i$ is the mean diameter of the two diameter classes of sieve (upper and lower) where percent weight (w_i) (taken in decimals by dividing percent value by 100) of total soil weight taken was retained. For example, in case of wet sieving using 4 sieves. There should be 4 mean diameter classes of aggregates/soil retained (AD1, AD2, AD3, AD4) which are simply the average of upper and lower sieve diameter and their respective percent weights (WC1, WC2, WC3, WC4).

Geometric mean diameter (GMD) = $exp^{(\frac{\sum_{i=1}^{n}(w_i \times \log \bar{x}_i)}{\sum_{i=1}^{n}(w_i)})}$

Where $\bar{x}_i$ is the mean diameter of the two diameter classes of sieve (upper and lower) where percent weight (w_i) (taken in decimals) of total soil weight was retained. For example, in case of wet sieving using 4 sieves. There should be 4 mean diameter classes of aggregates/soil retained (AD1, AD2, AD3, AD4) which are simply the average of upper and lower sieve diameter and their respective percent weights (WC1, WC2, WC3, WC4).

Soil chemical properties

Soil organic carbon stock (SOCS) (Mg/ha) = $\frac{Area(m^2) \times SOC(\%) \times BD \times SD}{100}$

Where SOC is the soil organic carbon concentration (%); BD is the bulk density (Mg/m^3) whose values comes from the calculations mentioned in their respective sections; SD is the depth of soil profile layer taken for calculation.

Soil organic carbon sequestration rate (SOCSR) (Mg/ha/year) = $\frac{Final\ SOC\ stock - Initial\ SOC\ stock}{Duration\ in\ years}$

Root

Relative root density (RLD) (cm/cm^3) = $\frac{Total\ root\ length\ in\ a\ core\ (cm)}{Volume\ of\ the\ core\ (cm^3)}$

Root surface density (RSD) (cm^2/cm^3) = $\frac{Total\ root\ surface\ area\ in\ a\ core\ (cm^2)}{Volume\ of\ the\ core\ (cm^3)}$

Relative weight density (RWD) (mg/cm^3) = $\frac{Total\ root\ dry\ weight\ in\ a\ core\ (mg)}{Volume\ of\ the\ core\ (cm^3)}$

Soil binding capacity (SBC) (kg/cm^2/plant) = $\frac{Total\ root\ dry\ weight\ in\ a\ core\ (mg)}{Root\ radius^2\ (mm)}$