

Pathways to precision in soil analysis: advancing soil laboratories in Latin America and the Caribbean

Caminos hacia la Precisión en el Análisis de Suelos: avance de los Laboratorios de Suelos en América Latina y el Caribe

Bulk Density

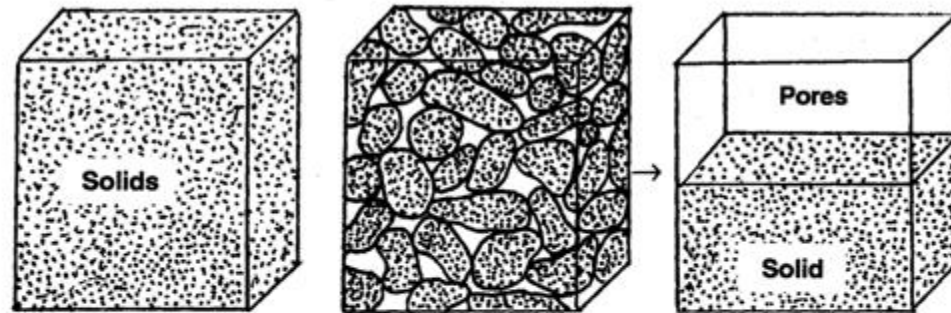
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8-11 APRIL 2024

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Definition

- Bulk density, also called apparent density, is defined as the total volume the particles occupy, including particle's own volume, inter-particle void volume, and the particles' internal pore volume



Particle Density

100% solid
Weight = 2.66 g
Volume = 1 cm³

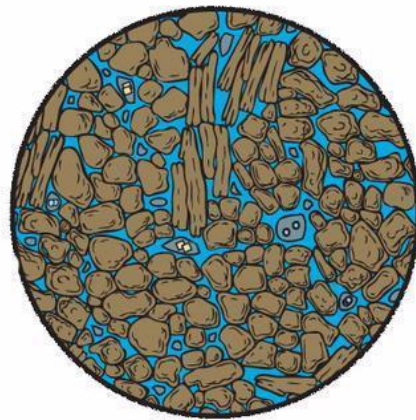
Bulk Density

50% solid, 50% pore space
Weight = 1.33 g
Volume = 1 cm³

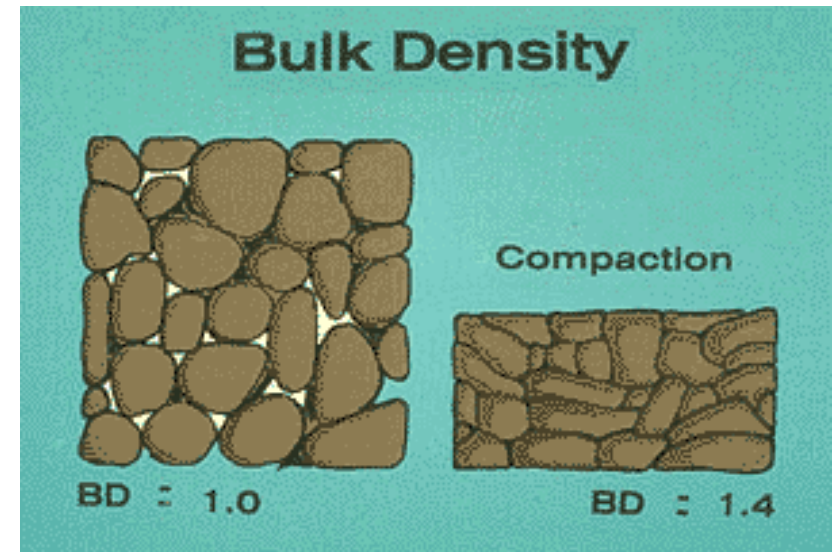
Implications



Lower bulk density
Lower weight
More pore space



Higher bulk density
Higher weight
Less pore space



Considering the same soil particle density.

Methodology

Figure 2. Field sampling set (this represents one possible device setup and others are possible, such as those with only a ring and a hammer)



Source: Elaborated by the authors

1. A soil sampling kit with cylinder holder with handle and hammering head.
2. An impact-absorbing hammer.
3. A brush and knife set.
4. A case to contain the tools.
5. A core cylinder.



Standard operating procedure for soil bulk density

Cylinder method



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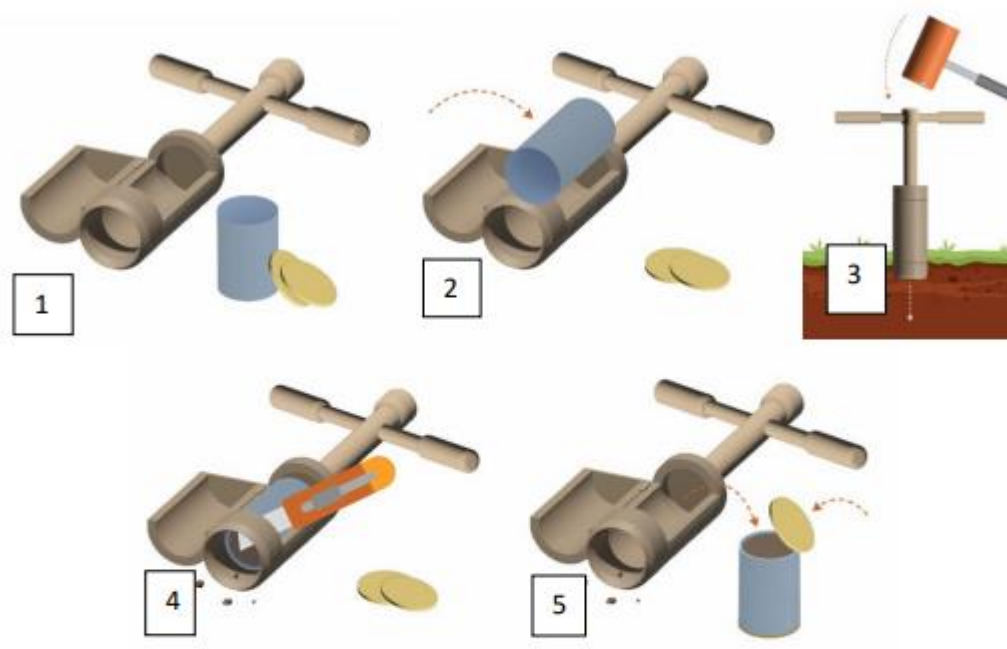
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Methodology

Figure 3. Use of sampler kit in the field



Source: Elaborated by FAO

1. Loosen the bolt that is located on the top of the sampler, open the sampling tube cover. Set the cylinder in the sampler. Close the cover and tighten the bolt.
2. Set the soil sampler straight to the ground. Beat the head little by little with a hammer. After beating to the depth of sampling, pull it up slowly, turning the handle to one direction.
3. Place the sampler in the ground and cut the bottom of the cylinder with the attached knife.
4. Remove the cylinder slowly.
5. Put the lids on the top and bottom of the cylinder and seal them with tape. (Note that this represents one possible device setup. Others are also possible, such as those with simply a ring and a hammer).

Methodology

Remove excess soil from the bottom of cylinder with serrated butter knife

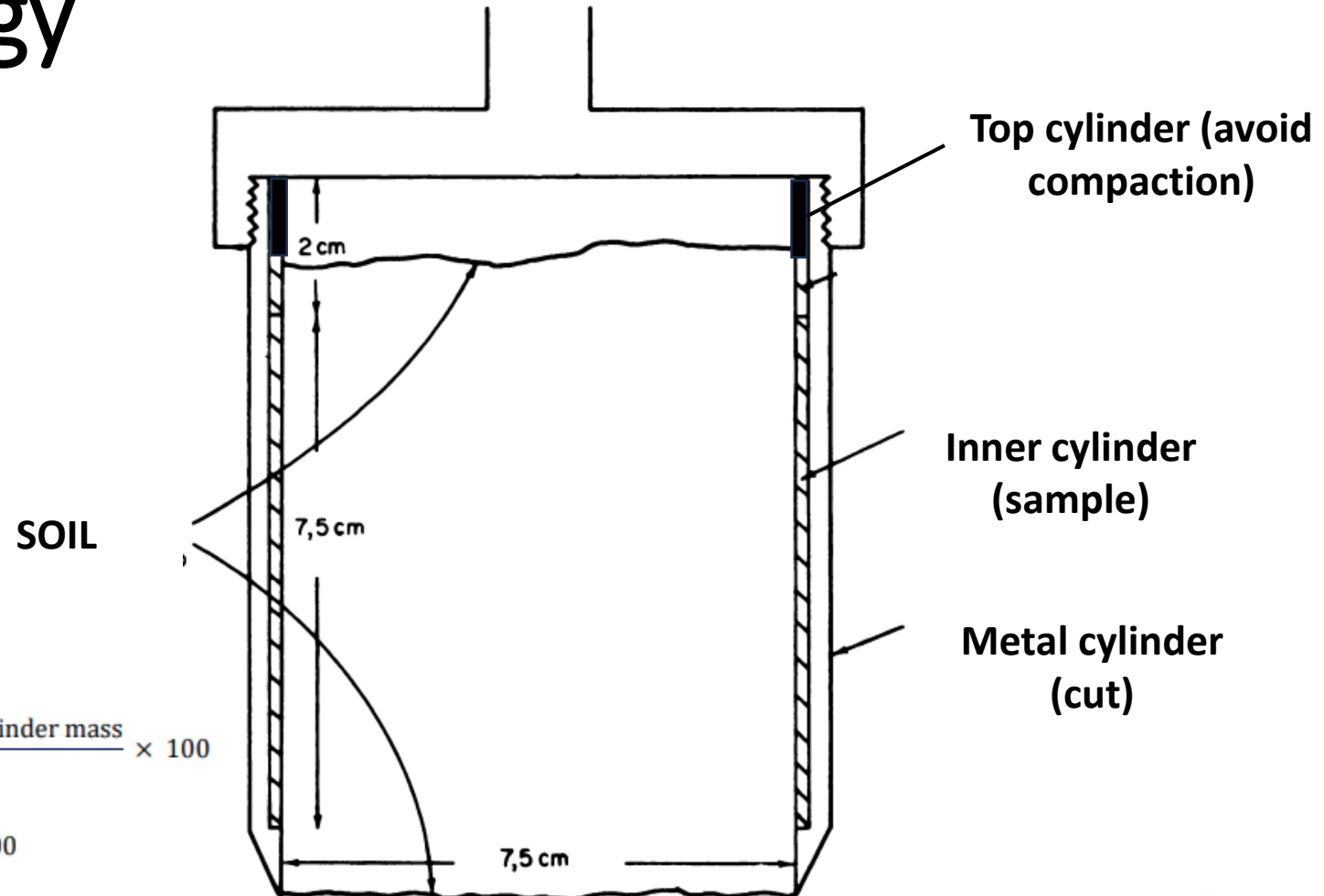
Place caps on both ends of the sample collection ring to maintain sample integrity.



Methodology

$$\text{Bulk density} = \frac{(\text{dry soil mass} + \text{cylinder mass}) - \text{cylinder mass}}{\text{volume of the cylinder}} \times 100$$

$$\text{BD} = \frac{\text{dry soil mass (g)}}{\text{volume of cylinder (cm}^3\text{)}} \times 100$$



Methodology



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Figures and Illustrations References

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- <https://www.fao.org/3/cc7568en/cc7568en.pdf>
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Thank you

