

Dry Farming Extension Guide

APPENDIX B: ESTIMATING SOIL BULK DENSITY

This is an appendix to the Dry Farming Vancouver and Gulf Islands Extension Guide. The guide provides a site suitability toolkit and shares lessons learned from dry farming trials on Vancouver and the Gulf Islands. To access all materials from the Dry Farming Vancouver and Gulf Islands Extension Guide see <https://www.kpu.ca/dry-farming-resources>

Bulk density is the dry density (weight/volume) of a soil.

Materials

- Shovel
- Rubber mallet
- Cylindrical core or ring (e.g. tin of canned beans with both end removed)
- Garden trowel
- Sealable plastic bag or container
- Microwave
- Microwave-safe container (e.g. ceramic)
- Kitchen scale

Method

1. Measure and record the height and diameter of the cylindrical core
2. Dig into the soil approximately 15 cm
3. Place the opening of the cylindrical core against the wall of the hole so that the length of the core is level with the surface
4. Use the mallet to drive the core into the soil until it is fully inserted and the opening of the core is level with the wall of the hole
5. Use the trowel to dig out the core, be careful not to lose any soil from the core when removing it
6. Use the trowel to make sure that the bottom and top of the sample are level with the surface of the core by removing any extra soil.
7. Use the trowel to push the soil sample from the inside of the ring into a sealable plastic bag or container. Make sure the entire soil sample is collected and none remains in the core
8. Label the container. Repeat steps 1 – 7 to collect two more samples into separate containers

9. Weigh a microwave-safe container and record the weight
10. Transfer the soil sample into the container and record the weight
11. Microwave the container for 4 minutes. Remove the container and weigh it
12. Continue to microwave the soil sample until the weight does not change and the soil can therefore be considered dry
13. Record the final weight of the dry soil and container
14. Calculate the volume of the core (see below)
15. Calculate the bulk density of each sample (see below)
16. Calculate the average bulk density of all three samples (see below)

Calculations

1. Calculate the volume of the core:

Core height (h) = _____ cm

Core diameter (d) = _____ cm

Core radius (r) = d / 2 = _____ cm

Core volume (V) = h x r² x 3.14 = _____ cm

2. Calculate the bulk density (ρ_b) is calculated as:

$$\rho_b = \frac{\text{weight of the dried soil (W)}}{\text{volume of the core (V)}}$$

3. Calculate the average bulk density as:

$$\rho_b \text{ average} = \frac{\rho_{b1} + \rho_{b2} + \rho_{b3}}{3}$$

Bulk Density Calculations Table

Sample Number	Weight of empty container	Weight of container and dry soil	Weight of dry soil only	Bulk density (ρ_b)
Sample 1 (ρ_{b1})				
Sample 2 (ρ_{b1})				
Sample 3 (ρ_{b1})				
			Avg bulk density (ρ_b average)	