

Exercises Soil and soil fertility

1. Explain what pedogenesis means and which five factors influence soil formation.

Answer: Pedogenesis is the scientific term for the process of soil formation. It occurs over very long time periods (hundreds to thousands of years). The five factors are: 1. Parent material (geology/rock type); 2. Climate (precipitation, temperature); 3. Organisms (plants, animals, microbes); 4. Relief/topography (slope, drainage); 5. Time.

2. Compare sandy and clay soils in terms of their water-holding capacity and workability. What are the advantages and disadvantages of each soil type?

Answer: Sandy soil: large pores → drains quickly, low water-holding capacity, warms up fast, easy to work. Disadvantage: drought-prone, low nutrient retention. Clay soil: tiny pores → high water-holding capacity, high CEC, rich in nutrients. Disadvantage: waterlogging risk, sticky and difficult to work when wet, compacts easily.

3. What is soil structure and which four processes lead to its formation? Explain why a loose soil structure is desirable for agriculture.

Soil structure refers to the arrangement of mineral particles and organic matter into aggregates. Four formation processes: 1. Coagulation (clay-COM bonding); 2. Freezing-thawing cycles; 3. Biological activity (earthworms, roots); 4. Wetting-drying cycles. A loose, crumbly structure is desirable because it allows good aeration, water infiltration, easy root penetration, and supports diverse soil life.

4. Explain the concept of cation exchange capacity (CEC). Why is a higher soil pH advantageous for nutrient availability?

Answer: CEC is the ability of soil (mainly clay minerals and humus) to hold positively charged ions (cations such as Ca^{2+} , Mg^{2+} , K^+ , NH_4^+) and exchange them with plant roots. Higher pH reduces the number of H_3O^+ ions competing for exchange sites, freeing up more sites for plant-available nutrient cations. Liming raises pH and therefore improves nutrient availability.

5. What influence does agricultural management have on COM content? Name at least three measures and explain their effect.

Answer: 1. Organic fertilisation (compost, manure) – adds organic matter, feeds soil organisms, raises COM levels. 2. Cover crops / green manure – keep soil covered, add biomass, prevent erosion and nutrient leaching. 3. Reduced/no tillage – reduces disturbance of soil structure, slows COM mineralisation. 4. Crop rotation with legumes – adds nitrogen and organic matter. 5. Avoiding bare soil – prevents erosion and COM loss.