

Study Questions: Soil Organic Matter and Soil Organisms

Note: This list is meant to help you learn the main points. They are not necessarily the exact topics or questions that will be asked on quizzes or exams. You'll see that there are more topics here than could possibly be on a single exam. But, by learning/understanding this material, you should be a long way toward doing well on the exams and final.

- 1) Carbon and nutrient cycling are among the most important processes done by soil microorganisms. What are the main steps / sequences (and corresponding terminology) that occur in the cycling of elements originally contained in living matter (beginning with the addition of plant or animal residue to the soil)?

- 2) These questions refer to Fig 11.1 in B&W Elem (and associated text in that chapter).
 - a) Where is most of the world's carbon stored?

 - b) Which of the following sends the most carbon back to the atmosphere each year - all *fossil fuel* use or release of carbon from the *soil*?

 - c) Where is more soil stored - in *soil* or in *vegetation plus the atmosphere*?

- 3) When plant or animal tissue is added to soil - which is the fate of most of the carbon?
 - a) formation of humus *or*
 - b) broken down to $\text{CO}_2 + \text{H}_2\text{O}$

- 4) What is *humus*?

- 5) Define *mineralization* and give an example.

- 6) Define *immobilization* and give an example.

- 7) Soil organisms are considered part of the total soil organic matter. What proportion of the total soil carbon are they?

8) List 5 factors that affect the rate of organic matter decomposition and describe why they are important.

- 1.
- 2.
- 3.
- 4.
- 5.

9) a) What types of organic compounds breakdown the most easily?

b) What types of organic compounds are most resistant to degradation?

10) Explain at least two ways that soil organic matter is beneficial for plant growth.

12) Why does soil disturbance (such as tilling) tend to decrease the content of soil organic matter?

13) Draw/Describe the differences in organic matter distribution with depth in the soil profile between 'conventionally' tilled land and 'no-till' land.

14) Explain how each of the following agricultural practices tend to affect soil organic matter content. (Note: we didn't go over these in class, but you should be able to answer these based on your knowledge of organic matter. In other words, some of these questions rely on being able to apply material learned in class to new situations).

- a) manure additions
- b) tile drainage
- c) tillage
- d) cropping sequence
- e) fertilizer additions

15) Why is it important to understand the role of soil organic matter when discussing global warming?

- 16) Soil organic matter has several direct and indirect effects on environmental quality. Describe the ways each of the following are influenced (at least partly) by the addition of plant residues to soil. (Hint - I got this question from Figure 11.10 in *Elem*)
- a) Soil erosion
 - b) Increased water availability for plants
 - c) Amount of flooding
 - d) Amount of pesticides used
 - e) Water pollution
- 17) Which classes of soil organisms are the most abundant? Have the most biomass?
- 18) Describe at least two ways in which soil organisms are grouped together (classified).
- 19) Which types of soil organisms exist in water films around soil particles? Are free-moving in soil?
- 20) a) What is meant if an organism is called a *producer*?
- b) What is meant if an organism is called a *primary consumer*?
 - c) What is meant if an organism is called a *secondary consumer*?
- 21) Define *hyphae* and *mycelia*.

22) What types of environments do each of the following classes of organisms prefer, and what do they eat?

a) bacteria

b) fungi

c) actinomycetes

d) algae

e) earthworms

23) Why are earthworm casts considered so 'wonderful' by many people who produce crops / vegetables / gardens?

24) Why are fungi the dominant organisms in acidic environments?

25) a. Define C/N ratio - both as an *equation*, and in *words*.

b. A soil sample is measured and found to contain (dry mass basis) 2% carbon and 0.2% nitrogen. What is the C/N ratio in this soil?

26) a) Why does the C/N ratio of residues added to soils matter (from a plant production perspective)?

b) If the residue C/N ratio is above about _____%, immobilization of nitrogen generally occurs.

27) List and describe two important types of mutualistic relationships between soil organisms and plants, including the types of organisms and plants involved in each.

28) List three ways in which soil organisms directly or indirectly improve soil aggregation and tilth.