

Soil microbiology

1

Read the following text and decide which of these adjectives could be used instead of those underlined in the passage: abundant, available, better, big, dangerous, entire, minute, productive, several, supreme, useful, vital.

Inorganic constituents (minerals, water, air), dead organic matter and soil life are the components that make up the total soil environment. The living portion of the soil can be divided into macro- and micro-organisms. Macro-organisms play an important role in organic decomposition by chewing plant and animal residues into fine particles. Though the micro-organic portion represents considerably less than 1% of the soil mass, it is on this tiny fraction that the continued re-cycling of nutrients mainly depends.

Normal, fertile soils teem with soil microbes. The most numerous microbes in soil are the bacteria followed by the actinomycetes, the fungi, soil algae and cyanobacteria (“blue-green algae”) and soil protozoa. In addition to the microbes, there are numerous species of soil animals that inhabit soils. These larger organisms can exert beneficial effects through improved soil structure and improved aeration and drainage due to their channelling activities in the soil.

Soil microbes produce lots of gummy substances that help to cement soil aggregates. Fungal filaments, called hyphae, also stabilize soil structure. Moreover, soil microbes are of paramount importance in cycling nutrients such as carbon, nitrogen, phosphorus, and sulphur and they can regulate the quantities of N available to plants. It is only through the actions of soil microbes that the nutrients in organic fertilizers are liberated for plants and use by other microbes. Soil microbiologists call this process mineralization. It is through such process that crop residues,

grass clippings, leaves, organic wastes, etc., are decomposed and converted to forms useable for plant growth as well as converted to stable soil organic matter called ‘humus’.

The large organisms function as grinders in that they reduce the particle size of organic residues making them more accessible and decomposable by the soil microbes. The soil microbial population also further decomposes the waste products of the larger animals. Thus, the activities of different groups of soil organisms are linked in complex “food webs”.

One beneficial process carried out exclusively by soil microbes is called nitrogen fixation, the capture of inert N₂ gas (dinitrogen) from the air for incorporation into the bodies of microbial cells. Another benefit of soil microbes is their ability to degrade pest control chemicals and other hazardous materials reaching the soil. Thus, through the actions of the soil microflora, pesticides may be degraded or rendered nontoxic lowering their potential to cause environmental problems such as ground and surface water contamination.

Some soil bacteria (the anaerobes) do not need air to grow and some are “poisoned” by exposure to oxygen. Generally, soil microbes grow best in soils of near neutral pH (7.0) having adequate supplies of inorganic nutrients (N and P, etc.), a balance of air- and water-filled pore space and abundant organic substrates (carbon and energy sources). Most soil microbes grow best at temperatures between 15-30 °C.

(By David A. Zuberer)

GLOSSARY



balance: equilibrium
carried out: performed, made
to cement: to reinforce
to chew: to masticate
clipping: cut off piece
drainage: removal of water
due to: caused by

to exert: to have
further: in addition
grinder: something that crushes into small pieces
gummy: sticky
to inhabit: to live in
lowering: reducing

reaching: arriving in
supply: provision
to teem with: to be full of
thus: so
tiny: very small
wastes: residues

2 Put the phrases in brackets in the suitable place to complete the passage below:

(bacteria, actinomycetes, fungi, algae and protozoa) - (e.g. addition of manure) - (e.g. floods) - (leaves, plants and remains of animal bodies) - (mainly carbon dioxide, oxygen and nitrogen) - (rodents, insects, worms, etc.) - (mineral particles) - (organic and inorganic) - (water)

Soil is made up of solid (.....), liquid (.....) and gaseous (.....) constituents and is the habitat of a great and varied population of microorganisms. The organic residue (.....) in the last stages of decomposition forms the humus. The biological systems in fertile soil include the root systems of higher plants, many animal forms (.....) and microorganisms (.....). The conditions influencing the microbial content of soil include: amount and type of nutrients (.....), available moisture, degree of aeration, temperature, pH, some agricultural practices (.....) and some natural occurrences (.....).

3 All the verbs have been removed from the passage below related to Soil microbiology. Put them back in the correct place.

are (4), break down, do, fertilize, grow, helps ensure, is, is filled, make up, need, release, see, use

Soil one of the most fundamental and basic of our resources – as much so as water and air. We healthy soil to food for human and other animals, and products that we on a daily basis. Soil with life. Whole communities literally under our feet. The work these communities is important. They the soil since they dead organisms and nutrients for use by leaving plants. Some microorganisms that these communities microscopic; others easy to with the naked eye but all of them vital to ecosystem health. The maintenance of viable soil biological communities long-term range land sustainability, clean water and clean air.

4 PAIR WORK. In turns, use these hints to ask and answer questions about the reading passage.

- What / constituents / soil?
- What / main microorganisms / soil?
- What / main functions / microorganisms / soil?
- What / 'mineralization'?
- What / function / larger organisms?
- What / 'nitrogen fixation'?
- How / soil microorganisms / help the environment / reduce water contamination?
- What conditions / soil microorganisms / require / growth?