MICRO LIFE IN THE SOIL

If one observes a handful of soil it can easily give the impression of being a handful of more or less dead material. But this is not true! Every single gram of soil crawls with life and activity. We just need to think in a totally different scale than we are used to. Billions of bacteria, millions of fungi and thousands of insects live in only one gram of fertile soil. If you add up the surface of all the small particles in one gram of soil you will get a total surface of up to 2 square meters. This surface is habitat for lots of microorganisms. A healthy and well functioning micro life, in the soil, is the basis for maintaining its fertility and hence a sustainable processing of the soil.

Plants need at least 17 different elements to grow. Some only in small amounts like trace elements, as in e.g. molybdenum. Other elements are needed in larger amounts, like e.g. nitrogen. Almost all these elements are present in different compounds and they are continuously converted in bio or geochemical circuits. Important processes, in for example the nitrogen, phosphor or sulphur circuit, are catalysed by microorganisms. Without their mineralising activities no life on earth would be possible.

Microorganisms are the last part in the food chain, when organic material is being decomposed, and their function as destructors (decomposers) secures that important elements remain in a closed circuit. They make sure that organic substances, like roots, leaves, plant residues, green manure, slurry, muck and dead animals that get into the soil are converted into an inorganic form that is available for the plants. This secures the nutrient supply for the plants. Opposed to humans and animals, plants cannot absorb and digest complex organic compounds. They are dependent on the inorganic, mineral form (nutrient salts). The soil would be nutrient poor without the microorganisms as the organic substances would no longer be mineralised.

The decomposition is often started by specialised microorganisms. The substances are only broken down to a certain level through the catalyst effect from the enzymes in the microorganisms. The following decomposition is taken care of by other groups of microorganisms, mutually succeeding each other. Environmental factors are very important here (temperature, humidity, pH value, oxygen concentration, etc.)

It is easy for the microorganisms to decompose some of the organic material from the plants. Carbohydrates (sugar, starch, cellulose, pectin, etc.) and also proteins and protein derivates usually are relatively easy to break down. On the other hand, substances like lignin, some types of fat, resin, wax, rubber, etc. are very difficult to attack and to break down. Natural substances, that are difficult to break down, cause an accumulation of half decomposed products in the soil. They are part of the humus formation and play an important part for the soil's fertility. Cellulose and lignin are important basis substances of the huminification and they are both substantial parts of the plant's cell wall. The organic material is decomposed and converted into amorphous, polymerous, dark coloured humin substances. These are mostly found in the topsoil and have positive influence on the soils fertility, ventilation and water reserves.

In addition to the mentioned decomposing activities, there also are other bacterial abilities that are of great importance to the soil's nutrition content. For example, some bacteria are able to fix elementary nitrogen from the air and covert it into a plant available form. As the amount of plant available nitrogen often is a limiting factor for the plant growth, this is a very important benefit. In addition, the microorganisms also help improving the soil structure. Fungus mycelium "cocoon" loose soil particles and bind them together like crumbles. Bacterial mucus glue small mineral particles together and thereby form stable structures.

Interaction between plants and microorganisms

The microorganisms also colonise the above-ground parts of the plants and belong to a complex eco system, comparable to the natural flora on human skin or mucosa. But also down in the soil many interactions between microorganisms and the plant roots take place. The plant roots absorb water and nutrition from the soil. Eventually, we now knows that the roots not only absorb substances from the soil but also give off a range of substances like sugar, enzymes or organic acids in the aria around the roots. These substances help release nutrients from the soil or function as nutrition for bacteria and fungi. Hence, it is no surprise that the amount of bacteria is much higher close to the roots (1-3mm), the so-called rhizosphere, than in the soil further away from the roots.

The rhizosphere gives the microorganisms a sort of “feed oasis” in a nutrient poor soil. The rhizosphere bacteria can help the plant to mobilise nutrients in the soil and to release plant growth hormones (Cytokinines, Auxines, Gibberellines) improving plant growth.
Not only benign bacteria live in the rhizosphere, but also pathogen bacteria that are a threat to the plant’s health. “Control organisms” make sure that these do not spread too disproportionately though. Hence, there is an organised “biological control” in the rhizosphere, where the rhizosphere bacteria protect the plant roots against pathogen bacteria.

In conclusion, it can be stated, that the microorganisms have a huge impact on the soil’s eco system and for the plants that set their roots in it. We know for sure that the soil’s microorganisms have a positive effect on the plant’s nutrient supply, their growth, their resistibility and the soil’s fertility and structure.

Several times, microorganisms with the qualities from the rhizosphere have successfully been isolated and cultivated in a laboratory. Trials have shown that plants, artificially grafted with multiplied rhizosphere bacteria, grow much better than not grafted control plants.

Microbiological garden and agriculture products give the opportunity to target the beneficial microorganism supply to the soil and profit from their widespread abilities. These products, as long as we are talking about natural microorganisms, are 100% sustainable and non-toxic.