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| Biological Factors of Soil Fertility  N.A. Krasilnikov from the Institute of Microbiology at the Academy of Sciences in Russia wrote *Soil Microorganisms and Higher Plants*, a book reviewing research on the relationship between soil fertility and biotic factors such as fungi, algae, and bacteria as well as larger creatures such as worms and insects [7]. Krasilnikov claims that "microorganisms constitute the most important and indispensable link in the nutrition of plants." Bacteria and fungi are important most obviously as decomposers in the soil. They make nutrients from humus (defined by Encyclopedia Britannica online as "nonliving, finely divided organic matter in soil, derived from microbial decomposition of plant and animal substances") available for plantsí use while eliminating unwanted waste [8]. Fungi are also useful in symbiotic relationships as myccorhizae which provide plants with more nutrients than they would be able to access otherwise by providing them with a larger surface area. Nitrogen fixing bacteria are known to be vital in the nitrogen cycle, converting it into a useable form for other organisms. This was discovered as early as 1889 when scientists Hellriegel and Voronin (1886) found that microorganisms were responsible for the nitrogen fixation in leguminous plants.  Worms and insects contribute to the soil after their death by adding organic material, but also in life. Worms affect the structure of soil by their excrements as well. Other organisms mentioned in the book were actinomycetes, ultramicrobes, and protozoa. There may be thousands or even tens of thousands of these in one gram of soil. The following descriptions come from information obtained from Encyclopedia Britannica [8]:  actinomycete-- a member of a heterogeneous group of gram positive, often anaerobic bacteria. It often forms mycelium and may form spores. The motile forms move by flagella and the common actinomycetes in soil are harmless to plants and higher organisms.  protozoa- Members of the subkingdom protozoa. They are simple but eukaryotic organisms and often exist as symbionts or parasites. Most protozoa are microscopic.  bacteriophage- any virus that infects bacteria.  nematode-also called roundworm. They may be found free living in soil or water, or as parasites in plants or animals. Nematodes are bilaterally symmetric, elongated, and often tapered at the ends. The ones in soil are generally microscopic.  The interactions between organisms in soil as well as the physical makeup of the soil itself all affect its fertility. The way water is held by the soil and the was nutrients are cycled in and out are important as well. If the makeup of soil is too porous or not porous enough then a plant cannot access the nutrients it needs. The relationship between plants and some specific types of bacteria (the ones responsible for nitrogen fixation) or fungi (such as those that are vital in orchids as myccorhizae) is an interesting one. If plants can utilize the nutrients produced or absorbed by their symbionts, then can they also utilize the metabolic products of free living organisms similar to such symbionts? Either way the plant benefits, assuming the nutrients are somehow absorbed. Thus the free living microorganisms in soil surrounding a plant can be as important to that plant as symbiotic bacteria in alfalfa or soybeans.  ([NEXT](http://docs.google.com/intro3.html))([BACK](http://docs.google.com/introduction.html))  [[Home](http://docs.google.com/home.html)][[Introduction](http://docs.google.com/introduction.html)][[Hypothesis](http://docs.google.com/hypothesis.html)][[Procedure](http://docs.google.com/procedure.html)][[Data](http://docs.google.com/data.html)][[Conclusions](http://docs.google.com/conclusions.html)][[Bilio/Links](http://docs.google.com/biblio.html)]  [[2001 Projects](http://docs.google.com/index.html)][[2000 Projects](http://docs.google.com/AP2000/index.html)][[1999 Projects](http://docs.google.com/AP99/index.html)][[1998 Projects](http://docs.google.com/AP98/index.html)] |