GOLD NUGGET

Provisioning Services – Production Of Food And Fibre Part 2

Bacteria and plant production

Many bacterial species that inhabit the plant root zone (rhizospere) have had beneficial effects on plant growth and productivity. These bacteria, called 'plant growth promoting rhizobacteria', help plants through several mechanisms, of which improved nutrition is one of the most important.

Even though nitrogen is the most abundant gas in the air, plants cannot utilise nitrogen gas and their growth are frequently limited by a shortage of nitrogen. An estimated 97 % of the natural nitrogen inputs in terrestrial ecosystems are from biological nitrogen fixation performed by 'nitrogen-fixing' organisms. These organisms, scientifically known as diazotrophs, can convert nitrogen gas into a form of nitrogen that plants can utilise. Many plants benefit from associations with either symbiotic or free-living diazotrophs. Legumes are well known for their symbiotic associations with the nitrogen-fixing Rhizobium bacteria in distinctive root nodules. Other types of plants, such as trees of the genus Alnus (alder), form symbioses with nitrogen-fixing actinobacteria of the genus Frankia. The majority of diazotrophs are not symbiotic but rather free-living inhabitants of the rhizosphere.

After nitrogen, phosphorus is often the most limiting resource for plants. Plants often associate with particular types of bacteria in their rooting zones to improve their access to phosphorus, which is often tightly bound to soil particles. Phosphorus solubilising bacteria: Rhizobium, Pseudomonas and Bacillus species, along with many other aerobic and anaerobic bacteria. One of the major mechanisms by which these bacteria solubilise mineral phosphate is through the synthesis of organic acids, which causes phosphorus ions to be released from more complex molecules. The abundance, diversity and metabolic activity of nitrogen-fixing and phosphorus-solubilising bacteria and archaea are influenced by many factors: soil chemistry, climate, plant community composition and land management.

Plant protection

Soil organisms also enhance plant production through their interactions with organisms that damage plants. For example, fungi of the genus Trichoderma are known to prevent fungal attacks and a wide range of bacteria have similar effects. Earthworms also have recognised effects as control agents for parasitic nematodes which are destroyed by nematode chemoreceptors during transit through earthworm guts by a proteolytic enzyme produced by specific bacteria; direct destruction of nematodes during the digestion process. Active antagonist relationships, predation and/or competition adjust community composition and abundance and may also help in conserving biodiversity. Food web controls in the plant rhizosphere are an example of such a process. Disturbances of natural or human origin may impair this dynamic equilibrium and produce uncontrolled multiplication of pests and disease agents. As a general rule, the simplification of the ecosystem and impoverishment of nutrient and organic matter reserves create conditions for these events by weakening plants' own defences and the community of organisms that naturally limit the impacts of these aggressive agents. Therefore, these plant-soil interactions can improve plant production, and also provide many other ecosystem services, and should be considered when designing crop management to sustain productivity.

Soil Lovers say: ***By Understanding This Wonderful Process One Can Allow Natural Systems To Do Their Job***

Ref: **A Global Atlas of Soil Biodiversity p98**