ORGANIC SUSTAINABLE SOLUTIONS THROUGH MICROBIOLOGY

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Bacillus Blend and its Role in Fertility

Bacteria are some of the smallest and most abundant microbes in the soil. In a single gram of soil, there can be billions of bacteria. There are an estimated 60,000 different bacteria species, most which have yet to be even named, and each has its own particular roles and capabilities. Most live in the top 10cm of soil where organic matter is present.

Some bacteria species are very fragile and can be killed by slight changes in the soil environment. Other species are extremely tough, able to withstand severe heat, cold or drying. Some can lie dormant for decades waiting for favorable conditions. Others can extract nitrogen directly from the air or break down some toxic substances.

Populations of microbes can boom or bust in the space of a few days in response to changes in soil moisture, soil temperature or carbon substrate. To gain advantage in this process, many microbes release antibiotic substances to suppress particular competitors. In this way some species can suppress other disease-causing micro-organisms.

Decomposers

Bacteria play an important role in decomposition of organic materials, especially in the early stages of decomposition, when moisture levels are high. In the later stages of decomposition, fungi tend to dominate. Bacillus Subtilis and Pseudomonas Fluorescens are examples of decomposer bacteria. Due to the metabolic diversity in the genus Bacillus, bacilli are able to colonize a variety of habitats ranging from soil and insects to humans. Bacillus Thuringiensis parasitizes insects, and is used for pest control. Although the most well known of the bacilli are the pathogenic species, most Bacillus are saprophytes that make their living off of decaying matter. Still others, namely Bacillus Subtilis, inhabit the rhizosphere, which is the interface between plant roots and the surrounding soil. The plants roots and associated biofilm can have a significant effect on the chemistry of the soil, creating a unique environment.

Nitrogen Fixers

Rhizobium bacteria can be inoculated onto legume seeds to fix nitrogen in the soil. These nitrogen-fixing bacteria live in special root nodules on legumes such as clover, beans, medic, wattles etc. They extract nitrogen gas from the air and convert it into forms that plants can use. Azotobacter, Azospirillum, Agrobacterium, Gluconobacter, Flavobacterium and Herbaspirillum are all examples of free-living, nitrogen-fixing bacteria, often associated with non-legumes.

Disease Suppressors

Bacillus Megaterium is an example of a bacterium that has been used on some crops to suppress the disease-causing fungus Rhizoctonia Solani. Pseudomonas Fluorescens may also be useful against this disease. Bacillus Subtilis is used to suppress seedling blight. A number of bacteria have been used for disease suppression. However, suppression is often specific to particular diseases of a particular crop.

Bacillus species construct antibiotics by synthesizing a wide variety of metabolites. Bacillus is generally found in soil, and represents a wide range of physiological abilities, allowing the organism to grow in every environment, and compete desirably with other organisms. Due to their capability to form extremely resistant spores, they produce metabolites that have antagonistic effects on other micro-organisms.

Aerobes and Anaerobes

Aerobic bacteria are those that need oxygen, so where soil is well drained aerobes tend to dominate. Anaerobes are bacteria that do not need oxygen and may find it toxic. This group includes bacteria that live inside soil aggregates. Anaerobic bacteria favor wet, poorly drained soils, and can produce toxic compounds that can limit root growth and predispose plants to root diseases.

Management of Bacteria

Though largely unaffected by cultivation, bacteria populations are depressed by dry conditions, acidity, salinity, soil compaction and lack of organic matter. It is very difficult to build desirable populations of bacteria without inoculations. The bacteria that is resident in soil is being overburdened by the demands of farming. Additionally, good farming practices require addressing soil health problems such as acidity and compaction. Adding organic matter like green manure, mulching, strategic grazing and minimum tillage all help keep populations healthy, but shear demand requires the inputs to be carefully thought out. Bacteria grow very quickly and can carry out the heavy lifting of fertility.