Arid Zone Times

An Arid Zone Trees Publication www.aridzonetrees.com info@aridzonetrees.com

Mycorrhizae and Desert Trees

Both agriculturists and horticulturalists have long understood the importance of soil microbes in the health of their crops and the productivity of their fields. Soils harbor large, complex, and highly interdependent populations of microorganisms of all types including fungi, bacteria, viruses, nematodes (microscopic flat worms), and yeast-like organisms.

These organisms can be divided into 3 general categories, those that directly and adversely affect plant growth and health (plant pathogens), those that promote or enhance plant growth (beneficial microbes) and those primarily involved in the decomposition organic matter. Many of these microbes are well documented to cause plant diseases like root and crown rots (fungi), crown gall (bacteria), and root knot (nematodes). The vast majority are actively involved in the decomposition of organic matter that gets incorporated in the soil. This decomposition process can involve the actions of a variety of microbes working in succession on the organic matter or many working simultaneously. It is clear that some microorganisms have intimate interactions with living plants roots and serve either a beneficial or protective function. Even in highly underdeveloped desert soils large microbial populations exist with many thought to be involved in enhancing the growth of native species. As far back as the 1950's actinomycetes (a group of bacteria-like organism known for producing human antibiotic compounds) were found associated with the roots of cacti in the Sonoran desert and assumed to be involved in their resistance to diseases. As members of the Pea Family (Legumes) many desert species can and do support populations of Rhizobia bacteria that allows tree roots to convert nitrogen gas from the air into forms of nitrogen that are essential to plant growth.

A number of specialized fungi have an intimate association with plant roots either by forming a dense fungal mat on the surface (called a mantle) with some fungal strands (hyphae) penetrating living root cells or acting like root hairs growing out from the surface of the root out into surrounding soil. These fungi are collectively called Mycorrhizae which literally means "fungus root." Mycorrhizae are thought to either protect the root from infection by detrimental soil microbes or to help the root absorb nutrients, like phosphorous, that are not readily available to the root because they are at low concentration in the soil or in chemical forms that are not easily absorbed by the roots. This relationship is called symbiotic, meaning both the plant roots and the fungi derive some benefit from their relationship.

In recent years commercial formulations of mycorrhizal fungi have been sold as soil amendments to promote plant growth. While there is an extensive research literature about the successful use of mycorrhizae under certain controlled experimental conditions, large-scale field tests have been largely inconclusive. Several factors may contribute to the lack of success in such field tests: 1) the fungi grow very slowly and the experiments may not have been of sufficient duration to demonstrate the effect, 2) soils were nutrient rich and the potential beneficial effect was not observed in such conditions, 3) fungi did not become established on the roots following inoculation and 4) fungi were not able to establish a symbiotic relationship with the plant roots or were not an appropriate match for the tree specie tested.

This last explanation is probably the most likely. Research has demonstrated that while mycorrhizal relationships are fairly common in woody plants, specific fungi are associated exclusively with certain hosts and attempts to make them colonize other plant species has been largely unsuccessful. The very delicate nature of the relationship between the fungus and the plant root suggests that this is a very specialized and highly unique interaction that may be limited to a very small number of fungi. Most of the commercial preparations currently being marketed are made up of fungi collected in forest habitats and are known to be associated with the roots of commercially important conifer species. Research is being conducted on desert adapted mycorrhizae, their distribution and effects on plant growth but to date these strains of fungi are not a part of the commercial preparations being sold. Perhaps research will yield desert-adapted strains and methodologies for successfully using these fungi to enhance the growth and health of desert tree species.