MYCORRHIZAE (MY • KO • RYE • ZEE)

WHAT ARE MYCORRHIZAL FUNGI?

Mycorrhizal fungi are certain kind of fungi which are specialized to colonize the roots of the majority of plants and form an organ called mycorrhiza.

WHAT IS A MYCORRHIZA?

The term mycorrhiza, in itself, implies the association of a fungus and a root. It is derived from the greek word "mykes" that means fungus and the latin word "rhiza" which means root. However, it has also been used to describe a mutualistic symbiosis because generally both partners benefit from their interaction.

WHAT ARE THE BENEFITS?

Mycorrhizal fungi produce filaments called hyphae that grow in and around the roots and develop an underground network that helps the plant to acquire mineral nutrients from the soil. In exchange, the fungus receives a place to live and carbon compounds for its own growth.

Examples of the positive impact of mycorrhizal inoculation on plant development and health are numerous and continually increasing. Mycorrhizal colonization has shown to improve the survival and growth rates of seedlings and cuttings of many ornamental plants (roses, verbena, chrysanthemum, geranium, begonia, hortensia, gerbera, sweetgum); vegetables (lettuce, onion, leek, celery, asparragus, pepper, cucumber, beans, tomato, strawberry, potato); and many tropical and temperate fruit crops (citrus, apple, almond, peach, olive, kiwi, cacao, papaya, coffee, avocado, pineapple).

Mycorrhizal plants are usually more tolerant to water and salt stress, and to transplanting shock. Furthermore, since mycorrhizal plants are more efficient in nutrient uptake, and more resistant to diseases caused by soil-borne pathogens, mycorrhizal inoculation offers the possibility to reduce fertilizer and pesticide applications. This may promote decreased leaching of nitrogen (N), improving compliance with stricter regulations for decreased N runoff. Mycorrhizal fungi absorb carbon via accumulation of glomalin, a glycoprotein that promotes soil aggregation and more rapid restoration of sites after disturbance.

Because of these benefits, there is increased interest in the implementation of mycorrhizal technology in agriculture, viticulture, horticulture and ecological restoration.

WHERE DO WE FIND MYCORRHIZAL FUNGI AND MYCORRHIZAS?

Under natural conditions mycorrhizal fungi are ubiquitous. They are found in the soil, mainly in the area surrounding the root system (the rhizosphere) in all types of climates, soils and ecosystems. In fact the association is so common in nature, that it has been stated that "*The majority of plants strictly speaking do not have roots, they have mycorrhizas*" (http://www.kent.ac.uk/bio/beg).

Approximately 95% of the world's present species of plants belong to families that form mycorrhizas. Therefore it is usually easier to list the families considered primarily nonmycorrhizal. Examples of nonmycorrhizal plants include mustards, chenopods, carnations, lupines.

Propagules of mycorrhizal fungi can be negatively influenced by damage to vegetation and soils.
Management practices such as tillage, application of mineral fertilizers and chemical pesticides, top soil removal or compaction can severely reduce or eliminate propagules of mycorrhizal fungi.

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TYPES OF MYCORRHIZAL ASSOCIATIONS

There are different types of mycorrhizal associations according to the fungi and plants involved and the morphological structures developed as a consequence of their interaction. At least seven types of mycorrhizal associations have been recognized, but the most widespread are the arbuscular mycorrhizas and ectomycorrhizas.

Ectomycorrhizas are formed by some Basidiomycetes and Ascomycetes (fungi that form mushrooms and truffles, respectively) with forest trees like oaks, pines, willows, Eucalyptus and some woody legumes. In general the fungus develops a sheath or mantle around the roots and a Hartig net between root cells.

Arbuscular mycorrhizas are formed by Glomeromycetes. Arbuscular mycorrhizal (AM) fungi consist of spores and hyphae, and they form mycorrhizal associations with most herbaceous plants and shrubs, many fruit trees, and agricultural crops. They are called arbuscular mycorrhizas because when the hyphae penetrate the root cortex they form tree-like structures called arbuscules within the cells. These arbuscules are the site of exchange between plant and fungus. Some AM fungi also produce vesicles to accumulate storage products, so this association has also been referred as vesicular-arbuscular mycorrhiza.

HOW TO OBTAIN MYCORRHIZAL INOCULUM?

The number of companies that produce mycorrhizal inoculum is expanding around the world. Therefore mycorrhizal inoculum can be purchased or propagated. Careful selection of commercial mycorrhizal inoculum is important because several studies indicate that some products do not always contain viable propagules of mycorrhizal fungi and that others contain fertilizers or other additives that confound the effects of mycorrhizal inoculation.

Mycorrhizal inoculum can also be incorporated by planting mycorrhizal plants from the nursery.

WHY DOES TREE OF LIFE NURSERY USE MYCORRHIZAL FUNGI IN OUR SOIL MIX?

The main objective of mycorrhizal inoculation at the Tree of Life Nursery is the propagation of healthy seedlings and cuttings of California native plants suitable to be transplanted in ornamental home gardens, restoration and revegetation sites. The symbiotic association with arbuscular mycorrhizal fungi improves the ability of plants to cope with environmental stress by facilitating nutrient uptake (Smith and Read, 1997), by increasing tolerance to drought and salt stress (Auge, 2001), and resistance against soil pathogens (Azcon-Aguilar et al., 2002), and by enhancing soil aggregation (Caravaca et al., 2002).

In contrast to native ecosystems where mycorrhizas are so common, soilless mixes used in nurseries for plant propagation do not contain propagules of mycorrhizal fungi (Azcon-Aguilar and Barea 1997). To incorporate mycorrhizal technology in nursery conditions it must be kept in mind that mycorrhizal associations are three way interactions between plants, fungi and growing media (Brundrett et al., 1996). Since the infectivity and effectiveness of a particular mycorrhizal fungus varies with the plant and the growing conditions (Corkidi et al., 2004; Corkidi et al, 2005), the successful application of mycorrhizal inoculum is related to the choice of potting mixes, fertilizers and pesticides, as well as to the screening and selection of functionally compatible plant-fungal associations (Turnau and Haselwandter, 2002).

CULTURAL CONDITIONS THAT PROMOTE MYCORRHIZAL FUNGI

Low/moderate soil nutrients
Soils with moderate-good CEC (presence of organic matter, clay)
Organic rather than inorganic forms of nutrients (especially for ectomycorrhizae)
Good soil drainage
Compatible pesticides

GREAT SOURCES OF INFORMATION ABOUT MYCORRHIZA

Mycorrhiza Information Exchange
http://mycorrhiza.ag.utk.edu/

International Culture Collection of Arbuscular and VA Mycorrhizal Fungi
(INVAM)
http://invam.caf.wvu.edu/

Working with Mycorrhizas in Forestry and Agriculture
http://www.ffp.csiro.au/research/mycorrhiza/

http://www.mycorrhiza.com

http://www.ctahr.hawaii.edu/oc/freepubs/pdf/SCM-5.pdf

http://res2.agr.ca/CRECO/mycor/bio_sols_e.htm

THE MATERIAL FOR THIS ARTICLE WAS PRIMARILY TAKEN FROM THE DOCUMENT:

Mycorrhizal Fungi in Gardens and Landscapes by Lea Corkidi and Edith B. Allen

and:

Selection of mycorrhizal fungi for California Native Plants, by
Lea Corkidi, Mike Evans and Jeff Bohn

Lea Corkidi
Tree of Life Nursery
San Juan Capistrano, CA
lcorkidi@aol.com

Edith B. Allen
Department of Botany and Plant Sciences
University of California, Riverside, CA
Edith.allen@ucr.edu