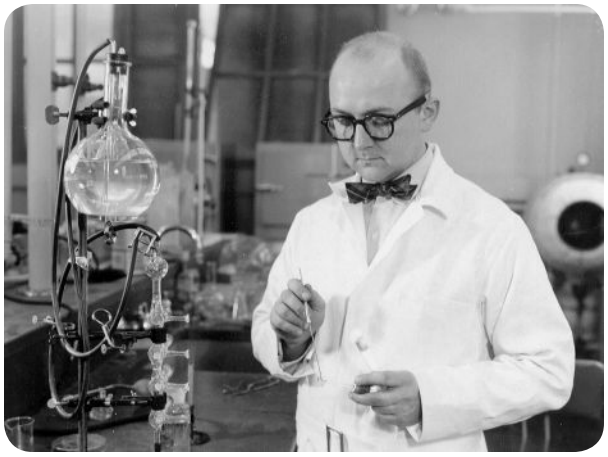
don't treat soil like dirt

Mycorrhizal Fungi

By Mike Amaranthus PhD*

For the last 20 years scientists have been intensely studying tiny soil organisms in the soil that will change the way you think about getting plants established. We have been delving into the distant past and we've uncovered a secret. The secret is hidden right beneath your feet.



Dr. Jim Trappe at OSU • one of the pioneers of Mycorrhizal research

Mother's Ancient History

Our landscape has not always been alive. 460 million years ago no plants covered the Earth's land surface. Compared to today the land was a barren, lifeless surface. Plants only existed in lakes and seas and lacked the elaborate root structure they needed to conquer the harsh conditions on the land.

Long ago on this ancient landscape the specialized fungus entered the primitive root of the aquatic plant. The fungal thread secured its energy source from the plant and, in return, the fungal filaments explored and mined the harsh earth's surface. The plant acquired the needed nutrients and water to sustain life from the fungus. The resulting evolutionary leap allowed plants to inhabit the land surface and has shaped life, as we know it today.

The mycorrhizal plant relationship not only still exists today, but has also become one of the most successful relationships on earth. Today approximately 90% of the world's plant species form the mycorrhizal relationship in varied natural habitats all over the world.

So How do Mycorrhizae Work?

The mycorrhizal fungi attach to the surface of the root and penetrate in or around the inside of the root cells. Then they send their filaments (called mycelium) into the surrounding soil, effectively extending the plant's roots and root absorbing capacity from ten to several thousand times – far beyond what the plant can do alone and thus improving plant establishment and productivity.

Several miles of these ultra-fine filaments can be present in less than a thimbleful of soil. Mycorrhizal fungi supply the water and nutrients needed by the plant for establishment and survival and, in return, receive from the plant roots sugars and other compounds needed by the fungus. Mycorrhizal filaments are much smaller than roots, so they can easily penetrate into smaller spaces between soil particles.

In the small nooks and crannies of the soil these tiny filaments release powerful enzymes that dissolve tightly bound minerals like phosphorus, sulfur, iron and all the major and minor nutrients used by plants. The nutrients are organically assimilated by the mycorrhizae and become readily available for use by the plants.

Mycorrhizae provide many other benefits to plants. The fungal filaments take up and store water, decreasing drought stress during dry periods. Plant roots are too thick to access the small pores that retain large amounts of water in the soil. The much thinner mycorrhizal hyphae easily penetrate into smaller spaces between soil particles and supply essential water during periods of moisture deficit.

The fungal filaments also bind soil particles into larger aggregates with organic glues such as humic compounds; the resulting soil structure allows air and water movement into the soil, encouraging root growth and distribution.

Granular Mycorrhizal Inoculum

Mycorrhizal Benefits

- Improved transplant survival and growth
- More effective rooting
- Improved soil structure
- Increased fertilizer utilization
- Decreased drought stress
- Tolerance of environmental extremes
- Reduces off-site pollution of surface and groundwater

When Do We Need to Apply or Replace Mycorrhizae in Our Soil?

Natural, undisturbed areas are teeming with a wide variety of mycorrhizal fungi. These areas have reached tremendous productivity and stability without chemical fertilizers, irrigation and pesticides. Healthy living soils conserve water and nutrients and protect the plants against stress and environmental extremes.

To achieve the benefits of the mycorrhizal relationship, they need to be present on your site. Most of our man-made environments were built using practices that destroy the soil conditions supportive of beneficial soil organisms. Studies have documented that in highly disturbed environments, plants have not formed mycorrhizal relationships even many years after planting and were surviving only through "intensive care" – i.e. fertilizers, pesticides and lots of water.

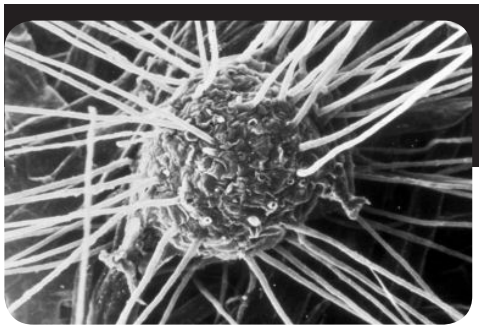
We now know mycorrhizal populations have been lost following construction activities. Vegetation removal, compaction, erosion, grading, topsoil removal, paving, pollution and the use of certain chemicals are just some of the practices that adversely affect mycorrhizal fungi. These conditions are definitely not the conditions that plants faced in their natural environments.

Re-establishing a Living Earth.

How do you re-establish mycorrhizal fungi once they have been lost from a site?

Recent advancements in our understanding of mycorrhizal fungi and their requirements has led to the production of high-quality, economical mycorrhizal inoculums at affordable prices. Mycorrhizal inoculums are currently available in granular, powder, liquid and even tablet forms. For more information on mycorrhizal fungi and their uses, visit www.mycorrhizae.com.

The most important factor for re-integrating mycorrrhizae is to get the mycorrhizal propagules near the root systems of target plants. Inoculum can be incorporated into the planting hole at the time of transplanting, watered into porous soils, mixed into soil mixes or directly dipped on root systems using gels. It can be broadcast, hydro-mulched or applied at seeding. The form and application of the mycorrhizal inoculum depends upon the needs of the applicator. What is clear is that on disturbed construction and stressed sites, inoculation is highly effective.



Mycorrhizal Filaments in Soil

If you are planning to add mycorrhizal fungi back to areas where they have been lost, make sure you use products that have a diverse array of species. Not all mycorrhizal fungi are created equal. Mycorrhizal fungi have different capacities and tolerances. For example, some mycorrhizal fungi have differing abilities to produce antibiotics that retard soil pathogens. Some are better at protecting plants from drought. Still other mycorrhizal fungi are better at producing enzymes that facilitate mineral uptake such as phosphorous, iron and others. Some mycorrhizal fungi can access organic forms of nitrogen. Mycorrhizal diversity ensures a range of benefits to the plant not found with only one species.

Don't Treat Soil Like Dirt

Disturbance activities and the widespread use of conventional fertilizers and pesticides have resulted in detrimental effects on our soils and environment. Impacts include high levels of run-off, erosion, compaction, contamination of lakes, streams and groundwater, salt accumulation and loss of soil structure. On large areas of the planet we have treated soil like dirt.

An attractive tool to diminish the environmental and dollar costs of these activities is to use mycorrhizal fungi as a natural plant growth stimulant. Using mycorrhizal fungi to establish and grow plants is borrowing from nature's template. Natural, undisturbed areas are teeming with a wide variety of these mycorrhizal fungi. Many of these natural ecosystems are the most stable and productive on earth, achieving great plant productivity and longevity without irrigation, fertilization or the use of pesticides. A healthy, robust, living soil conserves, transforms and utilizes soil nutrients and water and protects plants from diseases and environmental extremes. The key for the landscape architect is to recognize that soil is alive and deserving to be treated like the precious resource it is. For more information, visit www.mycorrhizae.com

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