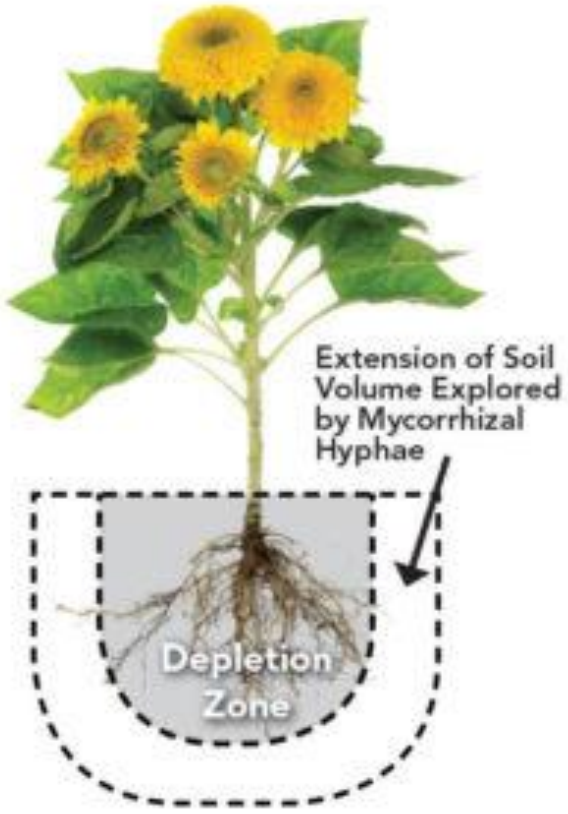
How Mycorrhizae Provide Value at Your Greenhouse or Nursery

December 6, 2017 By: **Jozsef Racsko** | **Hugh Poole**



Plant roots can only absorb a small volume of nutrients before they hit their depletion zone. One of the benefits of mycorrhizae is it can extend the depletion zone out into the growing media.

Plants have evolved over the years to develop several mechanisms that help them interact with microorganisms to acquire nutrients from the soil. One of the most widespread symbiotic relationships occurs between arbuscular mycorrhizal fungi (AMF) and most major agricultural crops and herbaceous and shrub species in natural ecosystems. This mutually beneficial relationship, known as arbuscular mycorrhizal symbiosis, facilitates nutrient

uptake and exchange between the plant and the fungi. The plant sends carbon (e.g., sugar, lipids) to the fungus, and in return, the fungus provides the plant with inorganic nutrients and water.

Mycorrhizae Extend the Depletion Zone

After establishing itself in the root tissues of the plant, the AMF develops an external mass of branched, tubular filaments (hyphae) that act as a bridge that connects the root with the surrounding soil microhabitats. Mycorrhizae serve as extended arms to the plant root system by boosting its capacity to uptake nutrients and absorb water. On their own, plant roots can only absorb a small volume of nutrients before they hit their depletion zone, which in simplest terms is the zone around roots (or fungal hyphae) where the concentration of nutrients is lower than in the surrounding bulk soil. The depletion zone is particularly important for immobile nutrients such as phosphorus.

To obtain more phosphorus, plants must overcome the limitations of this depletion zone. Mycorrhizal hyphae serve this very purpose by reaching out of the depletion zone, and improving the ability of the plant to access additional soil resources.

It is well documented that mycorrhizal symbiosis increases the absorption area of the plant roots by up to 50 times. The mechanisms by which mycorrhizae increase absorption include some that are physical and some that are chemical. Physically, most mycorrhizal mycelia (hyphae) are much smaller in diameter than the tiniest root or root hair, and thus can explore areas of the soil that roots and root hairs cannot reach, and provide a larger surface area for absorption. Chemically, the cell membrane chemistry of fungi differs from that of plants. For example, they can secrete organic acid that dissolves or chelates many ions, or releases them from minerals by ion exchange, converting these nutrients into bioavailable forms. This becomes important in root-bound situations (e.g., in containerized plants), where roots are limited to a small volume of soil and there is no possibility for the mycorrhizal hyphae to explore larger soil volumes.

Cost-Effective Uses for Mycorrhizae

Mycorrhizae are relatively easy to use in various horticultural applications. The key is that the mycorrhizal propagules (reproductive structures) need to be in close proximity to actively growing root tips, as root exudates (discharges of fluid) trigger the germination of the dormant propagules, and kick off the symbiotic colonization of the root system. These mycorrhizal inoculant products can be used as a seed treatment, applied to unrooted cuttings, incorporated into growing media, or even used as a drench or plug-tray dip.

Early colonization by the mycorrhizae is the most cost-effective, as young plants require less inoculum, and provides a faster response, especially for short-term crops grown in greenhouses. However, it is never too late to top-dress or incorporate the mycorrhizae into a container substrate or the landscape soil. The key is to mix the mycorrhizae thoroughly into the soil or to apply enough water to move them into the future root zone of the plant. For the landscape, spring and fall applications are preferable because the roots are more active than during the winter or summer.

Influence on Phosphorus Uptake

One of mycorrhizae's benefits is its ability to provide significant amounts of nitrogen and phosphorus to the plant in exchange for carbohydrates. If the plant receives extensive amounts of fertilizer, it will not signal the mycorrhizae to germinate and form the symbiotic colonization of the root system. High nitrogen levels increase vegetative growth at the expense of root growth, so reducing nitrogen levels in your fertility program benefits both the mycorrhizae and the plant. High levels of soluble phosphorus can inhibit colonization and mycelial growth, so it is recommended to use fertilizers with a low phosphorus concentration. For example, a fertilization program of 200 ppm nitrogen (N) using a 20-20-20 fertilizer could be reduced to 100 ppm N using a 20-2-20 fertilizer, which would reduce nitrogen by 50% and phosphorus by nearly 95%. Growers should consider these potential savings and plant enhancements based on their growing conditions. The use of controlled-release fertilizers is also a consideration for a lower fertility regime.

Rethink Common Production Practices to Preserve Soil Health

Mycorrhizae can be harmed by some horticultural practices. Steaming the soil after application of mycorrhizae is detrimental. A few fungicides can also harm germinating mycorrhizae propagules. An updated listing of the effects of fungicides on mycorrhizae is available at **Mycorrhizae.com**. If there are doubts, it is best to treat with fungicides two to four weeks after application of the mycorrhizae.

Although some benefits of mycorrhizae on a crop may occur after inoculation, it often requires four to eight weeks before there are visibly noticeable plant responses. When applied early in the crop cycle or at transplanting, benefits continue to develop as more roots develop, whether in a container or in the landscape. Mycorrhizae have an important role in horticulture, especially under stressful conditions, and they are not harmful to plants, people, or the environment.

Six Considerations for Choosing the Right Mycorrhizae Product

There are several mycorrhizal products on the market for professional growers. It is very important to make the right decision for product choice for best efficacy. When evaluating the available options, here are some important points to consider:

- Know your need. Mycorrhizal fungi can be used to increase water and nutrient uptake by enhancing root growth, maintaining optimal plant growth under stressful conditions, increasing general plant health, and reducing transplant shock.
- Established product performance. Make sure the product has been on the market for some time and its performance has been published in technical magazines/journals (i.e., tested by growers and independent researchers).
- Product quality. The product must contain viable and infective mycorrhizal inoculum at a rate that is listed on the label.
- Producer credibility. The producers/manufacturers have delivered what they promise on their label.
- Technical service. The technical staff of the producer/manufacturer can be reached with various technical questions and regarding product use. Larger, more reputable companies offer services such as testing the mycorrhizal colonization of roots after application to check product efficacy.
- Diversity of mycorrhizal fungal species. This is critical to achieve maximum efficacy. There are several species of mycorrhizal fungi in the soil. The mycorrhizal fungal community changes over time with plant phenology, season, microclimate, and soil conditions. Furthermore, different species are responsible for different functional benefits to the plant. Therefore, products containing multiple mycorrhizal species appear to provide more consistent benefits to the plant and ultimately to the grower.