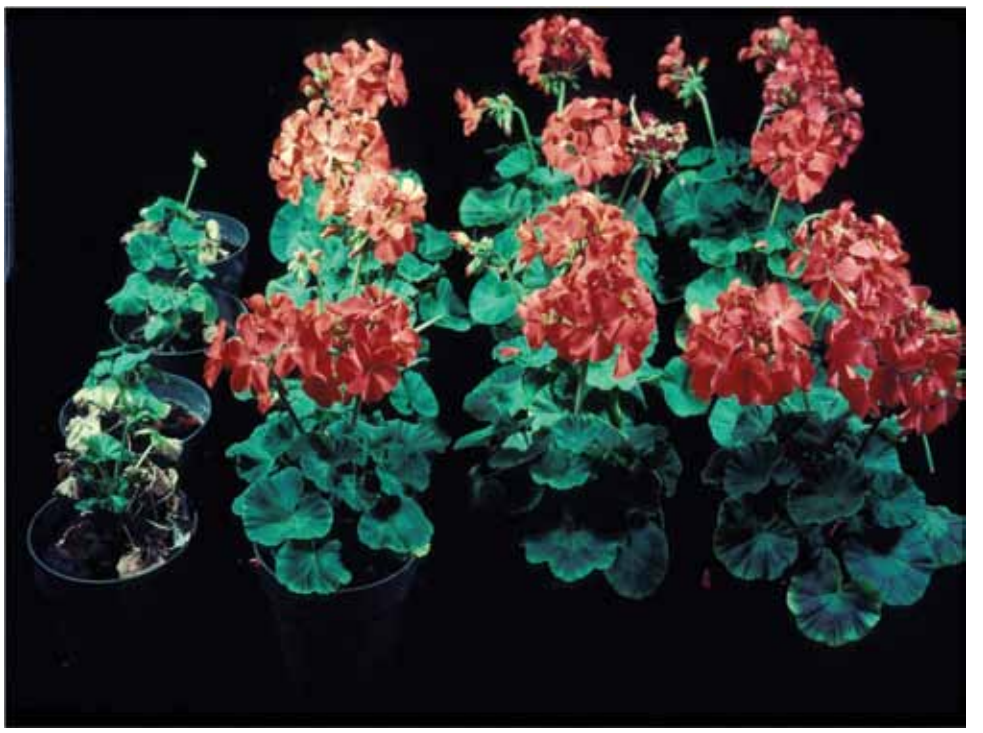
Using Mycorrhizae in a Professional Mix

WHAT IS MYCORRHIZA AND HOW DOES IT BENEFIT PLANTS?

By Michelle Miller

Growers have inquired about using mycorrhizae in professional peat and bark mixes. Most people are not familiar with mycorrhizae and there is confusion and misleading information in the industry about these beneficial organisms. This article is intended to answer these questions and provide a factual explanation about mycorrhizae, what these organisms are, how they benefit plants and how we can use them in growing media products

First, let's examine what a mycorrhiza actually is. The term mycorrhizae (plural) refers to a group of fungi, which form a symbiotic relationship with a plant's roots. The term symbiotic means an association between two living organisms that benefit both organisms. These fungi form an anatomical structure either inside of a plant's roots or on the surface of a root. The fungi benefits from the plant's photosynthetically produced carbon compounds (i.e. "food" and "nutrients"). In turn, and regardless if the mycorrhizae are growing inside the root or outside the root, the fungi send their hyphae out into the surrounding soil to absorb nutrients and water. As a result, mycorrhizae enhance a plant's ability to take up nutrients and water. By virtue of this fact, research has shown that the presence of mycorrhizae also helps plants deal with drought and some diseases. Approximately 95 percent of the world's plants have some form of mycorrhizal dependence. As far as greenhouse/nursery culture is concerned, in some cases, significant root and top growth is observed when plants are inoculated with mycorrhizae. These benefits are not always evident especially on short term crops, unless the crop is stressed. But these benefits will carry along with the crop even when planted into the landscape.



The effect of adding mycorrhizae to geraniums when grown in a low phosphorus mix. (Photo: Dr. Robert Linderman of Plant Health LLC)

Types of Micorrhizae

There are two main groups of mycorrhizae — ectomycorrhizae and endomycorrhizae. Both groups form associations with specific plant types. The first is ectomycorrhizae, which forms relationships with birch, oak, spruce, pine and fir. It forms an extensive hyphal network, which is frequently visible to the eye and is characteristic of this organism. Ectomycorrhizae is not important to most greenhouse growers since the above plant types are not typical greenhouse crops. Some of the species found in ectomycorrhizal product blends include *Rhizopogon villosulus*, *R. luteolus*, *R. amylopogon*, *R. fulvigleba*, *Pisolithus tinctorius*, *Schleorderma cepa*, and *S. citrinum*. If you examine some growing medium products or mycorrhizal blends, you will find large quantities of these "ecto" species, which are inexpensive and easy to grow, even if the product is not likely to be used for the susceptible plant species. The larger numbers look impressive on the label. However, if you are growing forestry seedlings or other tree species that form ectomycorrhizal associations, you should certainly look for these species in any blend you purchase.

The second group of mycorrhizae is endomycorrhizae, which are also known as vesicular-arbuscular mycorrhizae or VAM. Roughly 80 percent of all the plants in the world form associations with endomycorrhizae. So this is the group of mycorrhizae that is most important to greenhouse growers.

The primary genus in the endo group is Glomus and the largest species in this group is *Glomus intraradices*. Most plants form associations with *Glomus intraradices* and so, most endomycorrhizal inoculants contain *G. intraradices*. Other Glomus species, such as *G. mosseae*, *G.aggregatum*, *G. etunicatum*, *G. clarum*, *G. deserticola*, *G. claroidium*, and *Gigaspora albida*, form associations with plants to a significantly lesser scope compared to *G. intraradices*. You will find these other endomycorrhizae species in blended "endo" products along with *G. intraradices* with the intent that those blends will have a positive effect on a wider range of plant types. Secondly, it is thought that the addition of these other species to the *G. intraradices* helps or enhances the establishment of the *G. intraradices* organism.

When considering various mycorrhizal inoculant products, blends of endomycorrhizae will show much smaller numbers than ectomycorrhizae blends. For

example, you may see 0.2 propagules per cubic centimeter for a growing media containing an endomycorrhizae species. As mentioned above, cost is a factor.

Finally there is a smaller, third group of mycorrhizae, called ericoid mycorrhizae. This group of fungi colonizes ericaceous plants such as rhododendrons, azaleas and heathers. These plant types only form associations with these ericoid mycorrhizae and do not form associations with ectomycorrhizae or endomycorrhizae.

Also note that there are a few plant types that do not form any mycorrhizal association:

Brassica family (Broccoli, Brussel Sprouts, Cabbage, Cauliflower, Collards, Kale), Beets, Carnations/Dianthus, Mustard, Orchids, Protea, Rush, Sedge and Spinach

What Influences Mycorrhizal Growth?

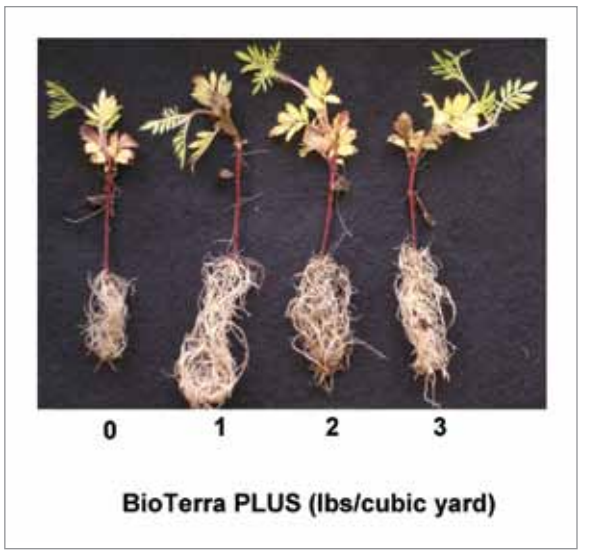
It is not difficult to create a beneficial environment for endomycorrhizal (VAM) colonies. Naturally, you need to have a plant that forms a symbiotic relationship with VAM. After that, the primary factor is the amount of inorganic phosphorus in the soil solution. Since the relationship between plant and fungi evolved to help the plants access low levels of phosphorus in the soil, mycorrhizae do not grow and colonize roots when the phosphorus level is high. Phosphorus levels above 10 ppm in the soil solution will impact the growth and establishment of mycorrhizae. This does not kill the mycorrhizae, it just creates an environment in which the mycorrhizae do not germinate and grow and it is rendered ineffective.

The mycorrhizal spores germinate in response to the release of sugars and hormones from the plant roots. This trigger allows the spores to stay dormant in a mix until plants are actively growing. Therefore, the shelf life of mycorrhizae is typically longer (up to two years) than other biological additives.

As far as is known, typical lime rates and medium pH levels of professional growing medium products do not have a significant positive or negative effect on the growth and colonization of mycorrhizae.

Growers often ask whether other biological products can be used with mycorrhizae. Rootshield and Actino-Iron have been shown in independent research to be fully compatible with mycorrhizae in soilless mixes, so these can be included if desired. There are other helper bacteria or fungi that are often added to a mycorrhizal blend. which stimulate and support the growth of the mycorrhizal colonies.

Chemical fungicides should be avoided especially at the start of production and until time has elapsed to allow root colonization to occur. One supplier of mycorrhizae, Mycorrhizal Applications, has information on its website (www.mycorrhizae.com) to suggest that most fungicides used as a root drench in greenhouse culture



Left: *The effect of adding mycorrhizae to lavender when grown in a low phosphorus mix. (Photo: Dr. Robert Linderman of Plant Health LLC)*
Right: *Marigold root growth different in treatments of 1, 1, 2 or 3 pounds per cubic yard of BioTerra PLUS added to a potting mix. (Photo: Dr. Mike Amaranthus of Mycorrhizal Applications)*

are OK at low rates, except for Etridiazol (Truban/Koban/Banrot) in which there is no information for VAM species. Etridiazol inhibits ectomycorrhizal growth.

Most professional growing mixes contain inorganic-based fertilizers. Our in-house research has shown very low levels of mycorrhizal colonies when a standard inorganic nutrient charge is used in the mix, which releases nutrients in a short time frame. However, we have found excellent colonization when mycorrhizae are added to mixes containing organic or controlled release fertilizers. Organic fertilizers "release" their nutrients slowly over time so the levels of phosphorus remain within a tolerable range for good mycorrhizal growth and colonization. Another option is to use an inorganic fertilizer charge with a low phosphorus content to allow the mycorrhizae to establish in the roots.

When you use a mix supplemented with mycorrhizae, a fertility program resulting in low levels of inorganic phosphorus should be employed. This means that any water soluble or controlled release fertilizer formulations should be low in phosphorus and delivered at a concentration or rate that result in 10-ppm phosphorus or less.

Excellent work has been done by plant pathologists and researchers to demonstrate the need for mycorrhizae in disturbed landscape, such as your garden, and soilless media. They are truly a key part of a healthy ecosystem in a gardener's soil. As a greenhouse grower, you can maximize the success of the consumer's purchase by giving your plants the additional support of including mycorrhizae in your growing media.

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