MYCORRHIZATION OF PINES

Jennifer Ryder-White
Horticulture Department
New Mexico State University
Las Cruces, New Mexico

Mycorrhiza, a term coined in 1885, literally means "fungus root". A mycorrhiza is a specialized root structure in which a fungus and plant root coexist mutually, each partner benefiting from the relationship. Pines develop ectomycorrhiza which usually consists of a swollen biforcated short root covered by a sheath of fungal tissue. Usually the fungus does not penetrate cells of the plant root; hyphal permeation is between cells of the cortical root tissue. The plant host supplies carbohydrates, vitamins, and other growth substances to the fungus. In turn, by increasing the root surface area and volume of soil exploited by the ectomycorrhza, the fungus increases nutrient and probably water absorption from the soil, especially under mineral-deficient or other imbalanced conditions.

It is believed that plants and their fungal partners have evolved to be dependent upon each other under natural conditions. Success or failure of seedling outplanting often can be attributed to the mycorrhizal inoculation potential of the soil into which the seedlings are planted. Conifer seedlings

planted on sites previously either uncultivated or under typical agronomic cultivation may especially benefit from mycorrhizal inoculation in the nursery. Container-grown inoculated seedlings may have increased chances of survival because the root system can remain relatively undisturbed during transplanting. Additionally, the mycorrhizal fungus is present in the rooting medium virtually predisposing the seedling to the beneficial partnership.

Soil duff or humus collected from established pine plantations or stands is the most widely used natural inoculum, especially in developing countries. Soil inoculum is generaly mixed into the growing medium at a rate of 1:10 inoculum:growing medium on a volume basis. Usa of fresh soil inoculum generally provides better reults than soil inoculum stored for long periods. Fruiting bodies (mushrooms) and spores of various fungi have been used as inoculum as well. If fruiting bodies are used, they must be dried and chopped before incorporation into the growing medium. Spores from mycorrhizal fungi may be collected for use as inoculum, however, however, the large numbers of spores needed may make this method less convenient. Spores of P. tinctorius are available from International Forest Seed Company, Birmingham, AL.

Vegetative mycelial inoculum of a mycorrhizal fungus, Pisolithus tinctorius, is currently

commercially available from Sylvan Spawn Laboratories, Kittanning, PA. Vegetative mycelium (tissue) of ectomycorrhizal fungi exhibits the greatest potential of inoculation success. Isolates of pure culture fungi are grown in a vermiculite-peat substrate moistened with a nutrient solution. Vegetative mycelial inoculum is mixed into the growing medium on a 1:10 volume:volume basis. Vegetative mycelial inoculum can be purchased in quantities necessary for the nurseryman's specific requirements.

Research has shown increased success of conifer seedling survival when inoculated at the nursery with an appropriate ectomycorrhizal fungus. However, the nursery industry has not yet included mycorrhizal inoculation into its standard production scheme. Mycorrhizal inoculation in the nursery has great potential for increasing conifer seedling establishment especially when plants are to be grown on "virgin" soil, e.g. desert or grassland regions.

Benefits to be expected from an ectomycorrhizal relationship may include 1) increased nutrient absorptioin, 2) increased resistance to soil-borne diseases, 3) tolerance to edaphic extremes in temperature, 4) salinity and pH, and 5) some mechanism for drought tolerance. All or any one of these factors contrubute to more vigorous and hearty seedlings, and

thus increase the chance of survival for transplanted conifer seedlings.