Abstract

Arbuscular mycorrhiza (AM) is the oldest and most widespread mutualistic symbiosis known. Colonization of host plants with arbuscular mycorrhizal fungi (AMF) provides a wide range of benefits to the host. The most obvious advantage is the ability to explore a larger volume of soil, by means of the extraradical mycelium (ERM), than plant roots alone can reach, allowing a better acquisition of water and nutrients. Although the uptake and transport of P is the most obvious benefit, absorption of other immobile nutrients, e.g., Zn and mobile nutrients, including N and S, are also significant. Several other ecological benefits are associated with AMF colonization plants, including alleviation of biotic, particularly soilborne diseases, and abiotic stresses, such as toxicity of metal ions and salinity. The formation and maintenance of soil structure is another relevant aspect of AMF that enhances soil functions that impact on the above benefits. In addition, communication between plants through common mycorrhizal networks and interactions with other soil microbes, as in the case of the tripartite symbioses between legume plants (Fabaceae), AMF, and nitrogen-fixing rhizobia are also important benefits of this symbiosis. To capitalize on the possible range of benefits an early and fast colonization of the host plant is essential; between possible AMF propagule types, an intact ERM is the most effective for this objective. Despite the apparent lack of specificity between AMF and host plant species, preferential associations exist with greater or lesser efficiency of the AM. Consequently a diverse population of AMF together with different host plant species increases the possibilities for successful combinations. Despite considerable evidence of the wide range of benefits in crop production granted by the AM symbiosis, there are constrains to the intentional use of AMF in agriculture. Major limitations are associated with the cost and efficacy of commercially available inoculum. Therefore the solution needs to be found through exploiting indigenous AMF, by adopting appropriate cropping systems, including diversified crop rotations and conservation tillage. Some preconceived ideas of incompatibility between common management practices and AMF, e.g., the use of P fertilizer rates or breeding programs that do not consider AM traits have been shown to be wrong.

Keywords: Arbuscular mycorrhiza; nutrient acquisition; biotic stress; abiotic stress; water relations; commercial inoculum; biocontrol; agriculture

practices