

Abstract

Early root colonization is crucial if the potential benefits from arbuscular mycorrhiza (AM) are to be optimized, especially when protection against biotic or abiotic stresses is involved, so that the AM is well-established as the host plant encounters the stress. Of the different arbuscular mycorrhizal fungi (AMF) propagules capable of infecting roots of a host plant, colonization from an intact extraradical mycelium (ERM) occurs earlier and develops faster than from spores, colonized root segments, or fragmented hypha. There is also evidence that the biochemical recognition dialogue between AMF and the host plant leading to a functional mycorrhiza is different for spores and intact ERM. An ERM is mainly composed of running hyphae and absorptive hyphae, with only the former being capable of infecting new roots. In contrast, absorptive hyphae have never been observed to act as units of infection and are identified as structures primarily involved in the acquisition of soil resources. Therefore it is considered that the ability of different AMF species to colonize from intact ERM is taxonomically based with Glomaceae and Acaulosporaceae being very effective, whereas members of the Gigasporaceae may regenerate mostly from spores. ERM has a considerable degree of persistence in the soil and plays a major role in improving the structure of soil that allows enhancement of soil functions. The ERM also establishes common mycorrhizal networks (CMN) between several coexisting host plants, including those from different species. CMN are considered to be major components of terrestrial ecosystems. The networks allow transfers of nutrients and signaling molecules between different plants. The cropping history for a particular site is very relevant in promoting ERM as the main AMF propagules to encourage the early establishment of an AM and capitalize sooner on its benefits. The design of appropriate diversified crop rotations is fundamental to ensure the persistence of a diverse AMF population in the soil. Such rotations must optimize the presence of mycotrophic plants from different functional groups, including the addition cover crops, and avoid long bare-fallow periods. Adoption of appropriate tillage techniques, which keeps the integrity of ERM, must also be considered in developing cropping systems that enhance the role of AMF.

Keywords: AMF propagule types; timing of colonization; benefits from early colonization; biotic stresses; abiotic stresses; agronomic practices; mycorrhizal networks