

Abstract

The potential benefits of arbuscular mycorrhizal fungi (AMF) are crucial aspects for the sustainable intensification of agriculture. However, in industrialized regions injudicious use of both manure and excessive application of fertilizers and pesticides are imposing unacceptable environmental impacts and in regions where there is already an urgent need to improve land productivity, the resources required to enhance productivity are scarce. The intentional use of AMF within agricultural cropping systems has received little attention, especially for large-scale production. Three key aspects prevent the full exploitation of AMF in agricultural ecosystems: the benefits of arbuscular mycorrhiza symbiosis (AM) are dependent on the biological diversity of both partners; the time required to achieve an effective colonization may restrict the benefits when protection against stresses are a major role of AM; the large cost of commercial inoculum coupled with its lack of biological diversity. These concerns clearly establish that the need to develop strategies for the management of indigenous AMF within different cropping system, specifically focusing on how to control the AMF biological diversity in the roots of the crops and to enhance early colonization. The answer to the latter is well-established in the literature and is the maintenance in the soil of an intact extraradical mycelium (ERM) to act as preferential AMF propagule. Under these conditions, colonization starts earlier and develops faster, enhancing the role of AMF in bioprotection of host plants. The management of AMF diversity present in the roots of a crop is still the major difficulty within the cropping systems. However, in a plant succession it appears possible to manage the AMF biological diversity present in the roots of the second plant if intact ERM developed by the first is the preferential initiator of colonization. This approach significantly improves the role of AMF in the protection of plants against biotic and abiotic stresses. Therefore the right choice of crop rotation, including cover crops or even the weeds that germinate before the seeding of the crop, and the adoption of appropriate tillage techniques that maintain the integrity of ERM, provide the potential to overcome the two major limitations to the intentional use of indigenous AMF within cropping systems. Criteria to select the plants to be included in a succession must be developed considering their different functional groups, which can be identified at least at the family level. For example, the Fabaceae and Poacea, harbor distinct AMF communities. These two plant families include many cultivated plants and, depending on the prevailing stresses, they can certainly provide useful candidates for this strategy. Numerous research requirements are identified but modern genomics technology brings the possibility closer that compatible assemblages of AMF and helper bacteria will be discovered.

Key words: AMF in agricultural systems; intact ERM; Developer plants; abiotic stresses; biotic stresses.