Preface

Arbuscular mycorrhizal fungi are ubiquitous soil organisms that form associations with roots of almost all plant species. They facilitate acquisition of nutrients by plants, contribute to processes associated with soil aggregation, and play understated roles in ecosystem function at various scales. They also participate in rhizosphere processes that protect plants against disease and improve access to water during periods of temporary or persistent water deficit. The effective management of mycorrhizal fungi is often an unrecognised component of sustainable agricultural production that contributes to the profitability of farming systems. During the restoration of disturbed lands, arbuscular mycorrhizal fungi contribute with ectomycorrhizal fungi to re-establishing effective nutrient cycling processes and other essential soil biological functions in ecologically significant plant communities.

At a fundamental level, recent advances in the taxonomy and techniques for recognising and assessing the diversity of arbuscular mycorrhizal fungi offer opportunities for reinvigorating research on the management of mycorrhizas in agricultural and natural ecosystems, including evaluation of their economic value. These advances provide the incentive for promoting knowledge of plant–mycorrhizal interactions in debates about soil and land management, fertiliser decision-making, implications for selection of crop rotations, choice of plant cultivars, maintenance of pastures and grasslands for animal production, and environmental impacts of intensive horticultural production. Although it is difficult to quantify the economic benefits of mycorrhizas, ignoring their roles will lead to failure in capturing their benefits. This will be even more important when the challenges of sustaining agricultural production using limited resources with low environmental impacts are highlighted in the coming years.

Appreciation of arbuscular mycorrhizal fungi as dynamic communities in the very contrasting environments of soil and roots is essential to managing their contributions through agronomic practices or inoculation. Competitive interactions among these fungi during colonisation of roots will influence dominance and function of both naturally occurring and introduced fungi as well as the survival from season to season of those which are most effective. Thus, inclusion of

arbuscular mycorrhizal fungi in biofertiliser formulations needs to be based on detailed knowledge of biotic and environmental interactions in space and time. A critical evaluation of the selection, technical production, and the use of inoculant arbuscular mycorrhizal fungi—in addition to the marketing of products containing these fungi—needs to be underpinned by sound comprehension of ecological concepts and principles.

Arbuscular mycorrhizas have the potential to mitigate nutrient loss by soil erosion and leaching, as well as increasing nutrient use efficiency. Renewed evaluations of dominant fertiliser inputs of both phosphorus and nitrogen require consideration of mycorrhizal associations, including avoidance of, or compensation for, negative effects of crop management on these associations. This extends to the role of arbuscular mycorrhizas in acquisition of zinc by plants. Furthermore, as arbuscular mycorrhizas can enhance plant survival and growth in extreme environments, research that highlights the potential for acclimation versus adaptation of mycorrhizal fungi will better inform management decisions in disturbed sites or in sites subject to temporary water deficit, salinity, or heavy metal toxicity.

Finally, an understanding of how roots are colonised by communities of these common soil fungi is essential for capturing their benefits. Predictive models that include spatial variability and soil mapping offer the potential for calibrating the impacts of soil properties and land use practices in sustaining the colonising potential of effective communities of mycorrhizal fungi. The role of mycorrhizas in soil carbon sequestration is of increasing interest, as is the potential for moderating their soil and rhizosphere environment by application of ameliorants such as biochar. However, for communities of arbuscular mycorrhizal fungi, their ubiquity and potential are generally hidden from the majority of land managers and thus overlooked. The intensification of agriculture for food production in the coming decades will benefit from the application of knowledge of molecular, physiological, and ecological function of arbuscular mycorrhizas via practical solutions to their use in sustainable agriculture and land restoration.

Crawley, WA, Australia — Zakaria M. Solaiman
Crawley, WA, Australia — Lynette K. Abbott
Noida, Uttar Pradesh, India — Ajit Varma

http://www.springer.com/978-3-662-45369-8

Mycorrhizal Fungi: Use in Sustainable Agriculture and Land Restoration

Solaiman, Z.; Abbott, L.K.; Varma, A. (Eds.)

2014, IX, 407 p. 8 illus., 5 illus. in color., Hardcover
ISBN: 978-3-662-45369-8