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EFFECTS OF ARBUSCULAR-MYCORRHIZAL FUNGAL COLONIZATION ON MANAGEMENT OF SALINE LANDS

Hamid Reza Asghari

Thesis submitted for the degree of

Doctor of Philosophy

in

The University of Adelaide

Faculty of Sciences

School of Earth and Environmental Sciences

The University of Adelaide

South Australia

August, 2004

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

SUMMARY

EFFECTS OF ARBUSCULAR-MYCORRHIZAL FUNGAL COLONIZATION ON MANAGEMENT OF SALINE LANDS

The overall aim of the research presented in this thesis was to evaluate the importance of arbuscular-mycorrhizal (AM) colonization of plants in management of saline lands. Some aspects of application of AM fungi in revegetation of saline lands are also reported.

Effects of AM pre-inoculation on mycorrhiza-responsive and non-responsive plant growth and establishment were evaluated under glasshouse conditions. The advantages of mycorrhizal fungal inoculation in increasing plant salinity tolerance and establishment in saline conditions were related to the responses of host species to AM fungi. Pre-inoculation with *Glomus intraradices* increased plant growth, nutrient uptake and establishment of mycorrhiza responsive *Trifolium subterraneum* in saline conditions, but non-mycorrhiza responsive *Festuca arundinacea* did not get growth benefits from AM in saline conditions.

The main mechanism underlying increased plant growth and establishment in saline conditions in mycorrhiza responsive plants was increased plant nutrient uptake, particularly phosphorus (P), at an early growth stage. The improvement could be explained by higher soil volume exploration by hyphae and/or roots, faster nutrient uptake and microbial changes in the soil rhizosphere.

AM inoculation and P application effects on salinity tolerance were compared in *Trifolium subterraneum*. Application of P increased plant growth and salinity tolerance in saline conditions, but AM inoculation increased nutrient uptake and plant salinity tolerance more efficiently than P application.

Effects of salinity on AM colonization of chenopods were investigated under glasshouse conditions. Salinity had no effects on AM colonization of *Atriplex nummularia*, but AM inoculation increased plant growth and nutrient uptake. The growth improvement was attributed to benefits from low AM colonization, and changes in bacterial community composition in the rhizosphere.

Roles of AM fungi in influencing P leaching from soil were investigated in experiments with repacked cores under both non-saline and saline conditions. Increased plant size via AM inoculation significantly decreased P leaching in the soil profile under both non-saline and saline conditions in low P soils. Increased root volume and extension external hyphal network were the main effects of AM fungi in increasing plant size under saline and non-saline conditions, which led to scavenging more P and depleting more soil available P, thereby decreasing P losses via leaching. Application of P increased plant size and decreased P leaching, but on the other hand increased soil available P and decreased AM colonization.

PUBLICATION FROM THE THESIS

Asghari H R, Smith S E, Chittleborough D J, Smith F A. 2003. The effects of mycorrhizal fungi on plant establishment in saline conditions. *Fourth International Conference of Mycorrhizas (ICOM 4*), *Canada*, *conference proceedings*, p 107. (Oral presentation)

DECLARATION

I declare that this thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution. To the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of this thesis.

I consent to this copy of my thesis, when deposited in the University library, being made available for loan or photocopying.

August, 2004

Signed

Hamid Reza Asghari

ACKNOWLEDGEMENTS

My deepest thank to Sally Smith, David Chittleborough and Andrew Smith for their supervision, encouragement and support throughout the entire period of this research. I really enjoyed their constructive comments, criticisms and discussions. I would like also to express my special thank to Petra Marschner for her teaching and technical support in this study.

I particularly want to thank Colin Rivers and Debbie Miller for their excellent technical assistances. I thank other member of soil biology group of Soil and Land Systems of School of Earth and Environmental Sciences at the University of Adelaide for many valuable discussions and their friendship. Special thanks to Timothy Cavagnaro, Sandy Dickson and Jan Jansa for their technical assistance and discussions during my research.

I would like to acknowledge the University of Adelaide and Sally Smith for their financial support and providing me the opportunity to travel to Canada to attend ICOM 4 conference and travel to Spain to discuss my work with other scientists.

I gratefully acknowledge Ministry of Science, Research and Technology of Iran, and Iranian Research Organization for Science and Technology for scholarship grants.

Thankyou my family, I appreciate your patience and support during my study in Australia.

Finally, I wish to express my deepest gratitude to my wife, Maryam for her assistance in the lab and understanding and support during my study. Without your help I never would have been able to do this research.

To my wife