Response of Root Properties to Tripartite Symbiosis between Lucerne 
\textit{(Medicago sativa L.)}, Rhizobia and Mycorrhiza Under
Dry Organic Farming Conditions

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Abstract: Problem statement: It is generally considered that root turnover is a major contributor to 
onorganic matter and mineral nutrient cycles in organic managed agroecosystems. Approach: This study 
designed to investigate whether microbial activity could affect on root properties of Lucerne in an 
organically managed field under dry weather conditions. The trial was laid out as a factorial 
experiment in the fields of the University of Natural Resources and Applied Life Sciences, Vienna-
Austria at Raasdorf in 2007. The experimental factors of Rhizobium \textit{(Sinorhizobium meliloti)} and 
Arbuscular Mycorrhiza (AM) including \textit{Glomus etunicatum}, \textit{G. intraradices} and \textit{G. claroideum} and 
irrigation levels were tested. Results: Results showed that increasing water deficit affected root dry 
weigh, specific root mass and root length significantly at 1% level and co-inoculation of rhizobium and 
mycorrhiza with irrigation increased all root parameters. Data’s of variance analysis for mycorrhizal 
colonization showed that main effect of using mycorrhiza had significant effects on root parameters at 5 
and 1% probability level at first and second harvest, respectively. Results of mean comparisons by 
Duncan’s Multiple Range Test showed that mycorrhizal colonization was higher in the inoculated 
treatments by rhizobium, mycorrhiza and irrigated plots in both harvests. Double interaction of 
mycorrhiza and irrigation was higher in both harvests (37.05 and 65.73%, respectively). Conclusion: It 
can be suggested that the tripartite symbiosis of Rhizobium, AM and Lucerne can improve the 
performance of Lucerne in organic farming and under dry conditions. Such traits could be incorporated 
into breeding programs to improve drought tolerance especially in organic fields.

Key words: Lucerne, root properties, mycorrhizal symbiosis, rhizobium, organic farming

INTRODUCTION

Most researches have focused on aboveground traits, relatively little attention has been paid to 
belowground processes such as root dynamics. Root production and mortality appear to occur 
simultaneously during the year and the stocks of live and dead roots reflect only the end products of these 
products. In other words, root accumulation in agroecosystems is ultimately controlled by the magnitude 
of root growth and turnover rates in the system. In recent years, agriculture has entered a period of major 
change. With increasing interest in sustaining economically viable crop production with minimal 
environmental impacts, farming without synthetic fertilizers and pesticides (organic farming) has been 
widely adopted as an alternative agricultural practice. Organic farming has to be self-sufficient in 
nutrients because the uses of chemical fertilizers are excluded. The cornerstone for soil fertility in organic 
farming is the use of those plants such legumes that are able to fix atmospheric N\textsubscript{2} and also remain residue in the 
soil. Lucerne \textit{(Medicago sativa L.)} is an important fodder legume in organic farming systems, mainly under dry 
site conditions. This plant improves the yield and quality of following crops by fixing nitrogen from the air, 
reduces diseases and weeds, increase soil organic matter contents and improves water infiltration. Also it 
has been well demonstrated that root production in such a plant like Lucerne found to be equivalent to, or greater 
than above-ground biomass. The amount of plant residues in the field has an important role to increase organic matter that improves soil fertility, microbial activity and water holding