THE EFFECT OF AMF INOCULATION ON GROWTH AND NUTRIENT UPTAKE OF TOMATO

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Introduction

Arbuscular mycorrhizal (AM) fungi are obligatory biotrophic symbionts living in the roots of most terrestrial plants. The great majority of the economically important crops, vegetables, fruits and ornamentals form AM symbiosis. AM fungi (AMF) have a positive effect on plant growth and plant nutrition, especially under stressed conditions (Marschner, 1997; Gáspár *et al.*, 2004).

The functional diversity of AMF community may regulate plant species diversity and play an important role in natural ecosystems (Szili-Kovács, 2004). About 150 AMF species are described which colonize the most of terrestrial plants. The probably large functional diversity within AMF species can supply the relatively fewer member of Glomeromycota species (Munkvold *et al.*, 2004).

The aim of the present study was to observe the relationship between the mycorrhizal dependency, the nutrient uptake of tomato (*Lycopersicon esculentum* L.) host plants and the rate of AMF colonization in a pot experiment.

Methods

The pot trial was set up on a sterilized calcareous chernozem soil (Nagyhörcsök, Hungary), in a growth chamber under controlled climatic conditions. The tomato (*Lycopersicon esculentum* L.) plants were inoculated with *Glomus claroideum* (BEG23), *Glomus fasciculatum* (BEG53), *Glomus geosporum* (BEG11), *Glomus mosseae* (BEG12) strains and a *Glomus mosseae*-2 AMF culture produced by us (5 w/w % AMF inoculum pot^{-1}). *Glomus mosseae*-2 originated from calcareous sandy soil in Hungary.

The dry biomass production, the micro- and macronutrient concentrations of the shoots and the parameters of the mycorrhizal infection were determined. The frequency (F%) and the intensity (M) of the mycorrhizal infection and the quantity of the arbuscules (a%, A%) were estimated by the five class system (Trouvelot *et al.*, 1986). The soil originated from selected plots of a long-term field experiment at Nagyhörcsök (Hungary) and classified as a calcareous loamy chernozem with the following characteristics: $pH_{(H2O)}$: 7,5; $pH_{(KCl)}$: 7,2; $CaCO_3$ content: 5-6,5%; humus content: 3%; clay fraction: (< 0,002 mm) 20%; silt (0,02-0,05 mm): 40%, AL-P_2O_5: 60-80 mg kg^{-1}, AL-K_2O: 140-160 mg kg^{-1}, total-N: 2100-2200 mg kg^{-1}, C/N ratio: 7.7-8.5 mg kg^{-1}.

Results and discussion

Intraspecific and interspecific differences were found in the infectivity and effectiveness of mycorrhizae within each AMF species. Each AM fungi species or isolate caused different and distinct changes on host plant growth and nutrient uptake. The biomass production of tomato increased significantly in the presence of AM symbiosis (Fig.1.).

The degree of host growth responses to AMF colonization is expressed as mycorrhizal dependency (MD) (Plenchette *et al.*, 1983). The mean values of MD were calculated with shoot dry matter and varied between 58% and 122%. The mycorrhizal inoculation improved the P, N, K uptake of tomato (Table 1.). The greatest root colonization, frequency of infection

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(F%) or arbuscularity (A%) were found in the root of tomato inoculated with the two *Glomus mosseae* strains (Fig. 2A.-B.).

Figure 1.: Biomass production of mycorrhizal and non-mycorrhizal tomato plants(g pot^{-1})

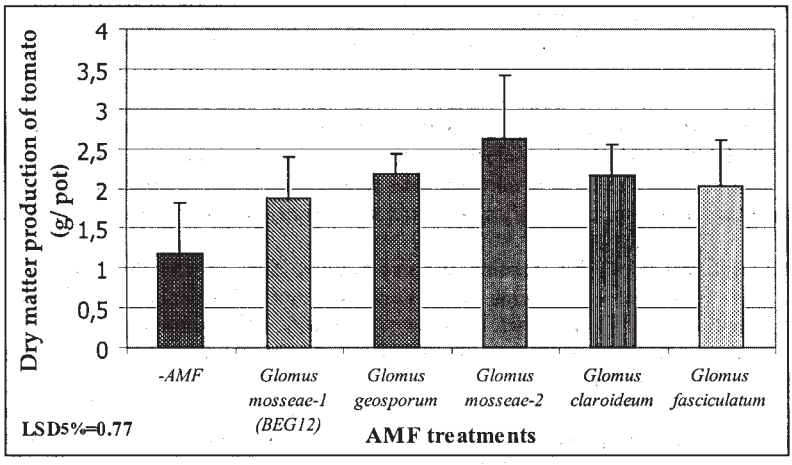

Table 1.: Nitrogen, phosphorus and potassium content of shoots of the mycorrhizal and non-mycorrhizal tomato plants

AMF treatments	Element concentrations in tomato shoots (mg kg^{-1})		
	Nitrogen (N)	Phosphorus (P)	Potassium (K)
Non mycorrhizal plants (-AMF)	24975	2517	42992
***Glomus mosseae* (BEG12)**	27750	3282	48642
Glomus geosporum	21160	3042	45320
Glomus mosseae-2	26500	3264	49406
Glomus claroideum	25275	3115	45162
Glomus fasciculatum	28250	3149	51547
LSD5%	2300	415	2950

The rate of AMF colonization (arbuscularity) showed a close correlation to growth responses and nutrient uptake of host.

Figure 2A.-B.: Extent of (A) AMF infection (F%) and (B) arbuscularity (a%) in tomato roots with colonized various AMF strains