

Effects of Arbuscular Mycorrhizal Fungi on Growth, P and Zn Uptake of Field Grown Onion

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INTRODUCTION

Arbuscular mycorrhizal (AM) symbiosis is widely spread in roots of higher plants, plays a key role in nutrient cycling and protects plants against environmental stress (Varma and Hock 1998). Mahaveer et al. (2000) showed that the inoculation of onion plants with AM fungi (AMF) can significantly increase bulb diameter, bulb yield, shoot dry and fresh weights and shoot P content. Furthermore, AM fungi can improve the uptake of P and other nutrients including N, Ca, S, K, Cu and Zn. However, results are not completely in agreement, because it also depends on plant species, soil fertility and experimental conditions (Mahaveer and Alok 2000, Khalied and Elkhider 1993, Azaizeh et al. 1995).

METHODS

The experiment was conducted at the Agriculture and Natural Resource Research Center of East Azarbaijan, Iran during two growing seasons in 2004 and 2005. Onion plants (*Allium cepa* L. cv. Red) were inoculated with one of the four AMF species: *Glomus intraradices*, *G. mosseae*, *G. versiforme* and *G. etunicatum* in a nursery. Control plants were left uninoculated in the nursery. After mycorrhizal establishment, seedlings were transplanted to plots without P fertilization or fertilized with 50 kg P ha⁻¹ as triple superphosphate. Soil available P (Olson) was 10 mg.kg⁻¹. One non-mycorrhizal plot received 100 kg P ha⁻¹ according to the recommended rate. Irrigation and other field practices were traditionally carried out. Bulb yield and the concentration of N, P and Zn in bulb were determined at the harvest.

RESULTS AND DISCUSSION

Mycorrhizal fungi and P treatments had significant effects on bulb yield, P and Zn concentration of bulb in both years. Bulb-N was not affected by the treatments. At each P level, the highest bulb yield was obtained in plants inoculated with *G. etunicatum* or *G. versiforme*. The highest P uptake was achieved by bulbs at both levels of P (0 and 50) inoculated with *G. versiforme*, and the uptake was equal to P uptake in 100 kgP.ha⁻¹ treated plots. Bulb-Zn significantly increased with *G. etunicatum* and *G. versiforme* in the absence of fertilization. Our results show that different species of mycorrhiza had various effects on the measured indices. Therefore, we need to notice these differences for selected effective species.

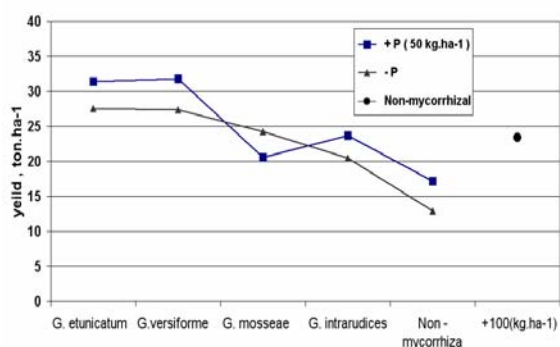


Fig. 1. Effect of treatments on bulb yield

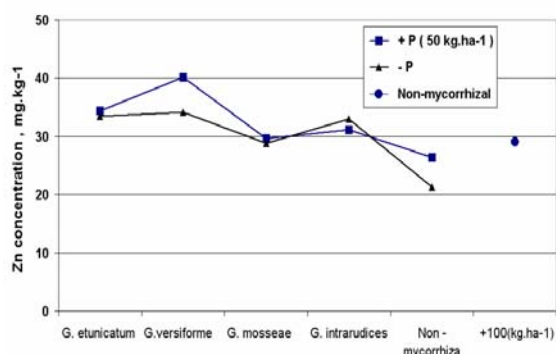


Fig. 2. Effect of treatments on Zn concentration in bulb

Table 1. Comparison of measured indices (means) in onion for two years (Duncan's multiple range test at 1%)

Treatment	Bulb Yield t ha ⁻¹	Bulb concentration mg kg ⁻¹			Bulb content kg ha ⁻¹		
		N	P	Zn	N	P	Zn
<i>G. etunicatum</i> + 50 kgP.ha ⁻¹	31.41 a	3.35	0.545 ab	34.33 ab	1057.6 a	174.3 ab	108.1 ab
<i>G. versiforme</i> + 50 kgP.ha ⁻¹	31.83 a	3.257	0.640 a	40.16 a	1039.3 ab	203.7 a	125.4 a
<i>G. mosseae</i> + 50 kgP.ha ⁻¹	20.53 abc	2.875	0.548 ab	29.66 abc	571.0 cd	109.4 bcd	58.2 cd
<i>G. intrarudices</i> + 50 kgP.ha ⁻¹	23.71 abc	2.855	0.552 ab	31.16 abc	677.3 abcd	128.8 abc	72.4 bcd
non-mycorrhizal + 50 kgP.ha ⁻¹	17.14 bc	3.387	0.458 bc	26.33 bc	579.7 bcd	78.108 cd	43.7 cd
<i>G. etunicatum</i>	27.54 ab	2.865	0.568 ab	33.50 ab	807.3 abcd	153.9 abc	88.5 abc
<i>G. versiforme</i>	27.31 ab	3.245	0.612 a	34.16 ab	852.9 abc	159.3 ab	84.8 abc
<i>G. mosseae</i>	24.24 abc	2.815	0.520 abc	28.83 abc	658.5 abcd	123.1 bcd	67.5 bcd
<i>G. intraradices</i>	20.44 abc	3.072	0.595 a	33.00 ab	611.8 abcd	117.7 bcd	65.4 bcd
non-mycorrhizal	12.94 c	2.982	0.415 c	21.33 c	381.4 d	53.1 d	26.8 d
100 kgP.ha ⁻¹	23.42 abc	3.025	0.613 a	29.00 ab	713.2 abcd	142 abc	77.7 bc

CONCLUSIONS

Based on our results, it can be concluded that the inoculation of onion plants with *G. etunicatum* or *G. versiforme* (effective species) and the application of P fertilizer at half rate (50 kgP.ha⁻¹) could improve bulb yield as well as Zn and P uptake by bulbs (increase quality and quantity of products). Also, inoculation with mycorrhiza can decrease P applications in plant production.

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