



Effect of Mycorrhiza fungi *Glomus etunicatum* on growth characteristics of barley which grown in nutrient solutions

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Abstract

This study was conducted at agricultural of plant production laboratories. The factorial experiment included studying the effect of two factors :First one : Urea at concentrations of (0 , 10 and 10 mg L⁻¹) dissolved in tap water second factor : Treated with Mycorrhiza (*Glomus mosseae*) in seeds of barley .A Completely Randomized Design (C.R.D.) were used with four replicates and means were compared according to L.S.D. test at the level of 0.05. The results were summarized as follows: Mycorrhiza treatment was significantly superior in germination % ,plant height, fresh and dry weight of shoots and roots (41.3%, 10.44cm, 13.7g, 7.02g, 18.5g, 10.13g plant⁻¹) respectively as well as Urea treatment(0.25g .L⁻¹) was significant and superior compared to other treatments in fresh weight of vegetative and roots (6.5, 18.6 g.plant⁻¹. Results also indicated that the interaction of Mycorrhiza with urea 0.25g.L⁻¹ had a significant increase in most of the studied indicators .

.Keywords: Mycorrhiza , barley and nutrient solution

Introduction

Barley (*Hordeum vulgare* L.) is one of the important cereal crops in Iraq and it comes after wheat rice and corn in terms of cultivated area and production, Barley has a nutritional value because it contains a high percentage of carbohydrate , amino acids and protein, its speed of growth ,tolerance to drought and salinity [1].T he need for this plant as fodder arose for the development of livestock production, which requires the addition of mineral fertilizers, especially nitrates, and thus the process of nitrification and volatilization of ammonia occurs, and the consequent increase in cost and pollution of the environment ,

Therefore, it required finding ways that are safe on environment and improve plant growth through the use of bio-fertilizers to raise the productivity of soil and agricultural crops production [2] Among these bio fertilizers was mycorrhizal fungus, which plays an important role in increasing plant's supply of the necessary macro and micro nutrients, as well as ensuring protection for the plant from pathogens [3] ,[4]. When treating plants with mycorrhizal fungus, it will increase photosynthesis processes through the absorption of nutrients, especially phosphorous, and the positive interaction between phosphorous and nitrogen, and their effect on increasing growth and yield [5].

The aim of this study is to the possibility of benefiting from Mycorrhiza fungus and different concentrations of urea to increasing vegetative growth of barley by liquid solutions.

Materials and methods

The experiment was carried out in the Graduate Studies Laboratory, College of Agriculture, Al-Muthanna University. They were filtered with tap water over dissolved urea in concentrations (0, 0.25, 0.5 and 1.0 g L⁻¹) which are denoted by symbols (F0,F1,F2 and F3) respectively : barley seeds were treated with Mycorrhiza fungus before sowing in containers which are denoted by symbols (T0 ,control and T1, with Mycorrhiza) respectively. All treatments were repeated 3 times . Each plastic container contains (100 seeds). Germination percentage , plant length , fresh and dry weight of vegetative and roots were recorded . The experiment consisted of a Completely Randomised Design (C.R.D) . Data were separated at a level of 0.05 .

Results:

Germination percentage (%) :

Mycorrhiza fungi treatment (T1) was superior in germination percentage compared with control treatment at a rate of (41.3, 32.5%), respectively, with an increase in germination percentage (27.07%).. Also data revealed that F2 (Urea 0.5g.L⁻¹) increased the germination percentage compared with the rest of treatments except F0, reaching (41.3, 40%) respectively. The data at the same table revealed significant differences between Mycorrhiza fungi and Urea concentrations. Best germination percentage was in F0T1 reaching 46.6%, compared to the lowest germination percentage (21.2%) in F3T0 (Table 1).

Table 1: Effect of Mycorrhiza and urea con. in liquid solutions on percentage of germination on barley seeds.

Mycorrhiza fungi	Urea Conc. (g.L ⁻¹)				Mean of Mycorrhiza fungi treatments
	0	0.25	0.5	1.0	
	(F0)	(F1)	(F2)	(F3)	

(T0)	33.5	32.7	42.5	21.2	32.5
(T1)	46.6	40.9	40.0	37.7	41.3
Mean of Urea treatments	40.0	36.8	41.3	29.4	
L.S.D._{0.05}	T=5.09	F=7.19	TF=10.17		

height plant (cm):

Data in table (2) showed that treatment of Mycorrhiza fungi (T1) was significantly superior in plant height as compared with control reaching (10.44, 9.33 cm) respectively, with an increase 11.89%. We noticed from the same table that there was no significant effect between the treatments of Urea concentration on height plant indicator. The interaction had a significant effect (Table 1), and the highest rate was in F2T1 (10.57cm), while the lowest rate was in F3T0 (9.03cm).

Table 2: Effect of Mycorrhiza and urea con. in liquid solutions on height plant (cm) in barley plants.

Mycorrhiza fungi	Urea Conc. (g.L ⁻¹)				Mean of Mycorrhiza fungi treatments
	0 (F0)	0.25 (F1)	0.5 (F2)	1.0 (F3)	
(T0)	9.57	9.33	9.37	9.03	9.33
(T1)	10.50	10.23	10.57	10.47	10.44
Mean of Urea treatments	10.04	9.78	9.97	9.75	
L.S.D. _{0.05}	T=0.521	F=N.S	TF=1.042		

Fresh weight of vegetative growth (g.plant^{-1}):

Results in Table 3 showed the superiority of Mycorrhiza fungi compare with control on fresh weight of vegetative growth on barley ($13.70, 9.82 \text{ g.plant}^{-1}$) respectively with an increase of 39.5%., which had an effective effect on increasing the rate of germination percentage and height plant, as mentioned in table 1 and table 2.

. Also data revealed that F2 was increased the fresh weight of vegetative growth compared with F3 treatments, reaching ($12.22, 11.22 \text{ g.plant}^{-1}$). For the interactions, data at the same table revealed significant differences between Mycorrhiza fungi and urea concentrations. Fresh weight of vegetative growth was in F0T1, reaching 14.97cm , compared to the lowest rat (7.97 cm) in F0T0

Dry weight of vegetative growth (g.plant^{-1}):

Based on the results in (tab.4), the treatment T1 was significantly higher in dry weight of vegetative growth ($7.02 \text{ g.plant}^{-1}$) compared with T0 treatments ($5.23 \text{ g.plant}^{-1}$),. Urea concentration F1 (6.5 g.plant^{-1}) significantly than other treatments except F2 ,F3 ($6.08, 6.05 \text{ g.plant}^{-1}$). The combination of F1T1 gave a higher rate $7.53 \text{ g.plant}^{-1}$ while the F0T0 gave the lowest average of 4.37.

Table3: Effect of Mycorrhiza and urea con. in liquid solutions on fresh weight of vegetative growth on barley (g plant^{-1}).

Mycorrhiza fungi	Urea Conc. (g.L^{-1})				Mean of Mycorrhiza fungi treatments
	0 (F0)	0.25 (F1)	0.5 (F2)	1.0 (F3)	
(T0)	7.97	9.93	11.27	10.10	9.82
(T1)	14.97	14.50	13.00	12.33	13.70
Mean of Urea treatments	11.47	12.22	12.13	11.22	
L.S.D. _{0.05}	T= 0.707	F=1.000	TF=1.414		

Table 4 : Effect of Mycorrhiza and urea con. in liquid solutions on dry weight of vegetative growth on barley (g.plant⁻¹).

Mycorrhiza fungi	Urea Conc. (g.L ⁻¹)				Mean of Mycorrhiza fungi treatments
	0 (F0)	0.25 (F1)	0.5 (F2)	1.0 (F3)	
(T0)	4.37	5.47	5.60	5.50	5.23
(T1)	7.40	7.53	6.57	6.60	7.02
Mean of Urea treatments	5.88	6.50	6.08	6.05	
L.S.D. _{0.05}	T=0.447 F=0.631 TF=0.893				

Fresh weight of roots (g plant⁻¹):

Table 5 showed that T1 treatment was significantly superior in fresh weight of roots (18.5 g plant⁻¹) comparing to (15.05 g plant⁻¹) in T0, Moreover, F1 and F2 was highest in fresh weight of roots (18.6 and 18.4 g plant⁻¹) compared with F0,F3 (13.3,16.8 g plant⁻¹) respectively. Interaction between Mycorrhiza and urea concentration treatments revealed that the combination of F1T1 gave the highest average of 21.0 g.plant⁻¹ while treatment control F0T0 gave 10.6 g.plant⁻¹ .

Table 5: Effect of Mycorrhiza and urea con. in liquid solutions on fresh weight of roots on barley (g plant⁻¹).

Mycorrhiza fungi	Urea Conc. (g.L ⁻¹)				Mean of Mycorrhiza fungi treatments
	0 (F0)	0.25 (F1)	0.5 (F2)	1.0 (F3)	
(T0)	10.60	16.20	17.80	15.60	15.05
(T1)	16.00	21.00	19.00	18.00	18.50

Mean of Urea 13.30 18.60 18.40 16.80
treatments

L.S.D._{0.05} T=1.291 F=1.826 TF=2.583

Dry weight of roots (g.plant⁻¹):

The results presented in Table 6 showed that Mycorrhiza fungi T1(10.13 g.plant⁻¹) significantly exceeded T0(8.15 g.plant⁻¹),. Furthermore, no significant differences were found between F1 and F2 treatments in fry weight of roots (10.17 and 10.22 g.plant⁻¹) respectively as compared with (7.1 g.plant⁻¹) for F0 treatment.. The combination of F1T1 Gave a higher range(11.83 g.plant⁻¹) while the treatment control F0T0 gave the lowest range (5.73 g.plant⁻¹).

Table 6 : Effect of Mycorrhiza and urea con. in liquid solutions on dry weight of roots on barley (g.plant⁻¹).

Mycorrhiza fungi	Urea Conc. (g.L ⁻¹)				Mean of Mycorrhiza fungi treatments
	0 (F0)	0.25 (F1)	0.5 (F2)	1.0 (F3)	
(T0)	5.73	8.50	9.97	8.40	8.15
(T1)	8.47	11.83	10.47	9.73	10.13
Mean of Urea treatments	7.10	10.17	10.22	9.07	
L.S.D. _{0.05}	T= 0.636	F=0.899	TF=1.271		

DISCUSSION :

The improvement in germination performance percentage . Fresh and dry weight of vegetative growth and roots in barley could be due to the role of Mycorrhiza. The later is likely to increase (facilitation) of phosphorus uptake by dissolving phosphates in soil solution into susceptible ions and make them easily absorbed by plant roots [6]. Mycorrhizal fungi

play a role in increasing the absorption of other essential nutrients such as nitrogen and potassium, since the mycorrhiza fungus will increase the surface area of the root hairs, which leads to an increase in the positive effect on vegetative growth and fruit formation in plants.. This finding is in agreement with [7] , [8] , [9] , [10] and [11] . The improvement in performance fresh and dry weight of vegetative and roots in Urea Treatment (0.25 g.plant⁻¹), Perhaps the reason is due to the ideal concentration of nitrogen and Perhaps the reason is due to the use of the optimum concentration of nitrogen, which gave these moral characteristics this agree with [12].

Conclusion :

Significant increase in the percentage of germination and wet and dry weight of plants and roots treated with mycorrhizal fungi and urea additions, especially with the concentration (0.25 g urea L⁻¹) in a liquid solution to produce sprouted barley.

References:

- Ben, M. ; M. Al-Taher and I. A.Al-Ferjani. (2012).** Effect of biofertilization with Spp Azotobacter and different rates of urea fertilizer on barley plant growth. Syrian Journal of Agricultural Research. 3 (1): 213-219.
- Osip, C.A.; S.S. Ballescás; L.P. Osip; N.L. Besarino; A.D. Bagayna; and C.B. Jumalon (2000).** Philippine council for Agr. Forestry and Natural Resources. Research and Technology. 134: 17-18.
- Clark, D. J. Durner, D. Navarre and D. Klessig (2000).** Nitric oxide inhibition of tobacco catalase and ascorbic peroxidase. MPMI. (13) : 1380-1384.
- Mahdi, S.S., G.I. Hassan, S.A. Samoon, H.A. Rather, S.A. Dar and B. Zehra (2010).** Bio-fertilizers organic agriculture. Journal of phytology. (2) (10): 42-54.
- Al-Samarrai, I. K. ; H. S. Rahi and I.. A. Ahmed (2007).** The response of maize to organic and biological fertilization, and the relationship between grain yield and the content of elements in leaves and soil. Iraqi Agricultural Journal. 38(1) .64-55.
- Raheem, A. and F. H. Issa .(2018).** Evaluating productivity of an eggplant as influenced by Mycorrhiza fungi and other selected fertilizing materials . Merit Research Journal of Agricultural Science and Soil Sciences . 6(9) : 118-122.
- Saleh MM (2006).** The role of Mycorrhiza and super phosphate fertilizer and phosphate rock on growth and production of tomato. Master Thesis, Faculty of Agriculture, Baghdad University. Iraq.
- Hussein AS, Madi Al, Nazir AM (2007).** Effect of the use of Mycorrhizus fungus and root contract bacteria on growth of yellow corn and hummus plant. Karbala Scient. J. 5(2):pp 6.
- Abdel Hamid, B. A. and A. M. Sharif (2015).** Effect of Mycorrhizae mosseae Glomus and Aspergillus fungi.niger in

the phosphorous ratio of phosphate rock and some elements and wheat growth. Journal of Tikrit Ma'amom Agricultural University. 15 (1):.90-108

Al-Taie,H. A. M.(2016). Effect of Mycorrhiza *Glomus mosseae* and spraying of *Hibiscus sabdariffa* L. extract on growth and production of four hybrids of cucumber (*Cucumis sativus* L.). Master thesis . Agriculture Faculty , Al-Muthanna Uni.Iraq.

Raheem,A. and Issa ,F.H.(2019). EFFECT OF ORGANIC FERTILIZER AND MYCORRHIZA FUNGI ON SOME PHYSICAL AND CHEMICAL PROPERTIES OF SOILS. *Plant Archives* Vol. 19, Supplement 1, 2019 pp. 534-537

Issa,F.H.(2016). Propagation of Potato Seed Tubers using Nutrient Solution in Hydroponic and Sand Culture. *International Journal of Multidisciplinary and Current Research*(ISSN). Vol.4:1104-1106.