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Annals of Biological Research, 2012, 3 (2):1109-1116

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Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

Mycorrhizal bio-fertilizer applications on yield seed corn varieties in Iran

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ABSTRACT

Today the use of chemical fertilizers to the problems of society has imposed. However, the important role of biological fertilizer in the food plants supply and reduce the environmental impact has been proved. Considering that, one the goals of producing is access to healthy seed and seed quality and high production capacity, in order to examine the effects of biological fertilizer mycorrhizal on the properties of corn seed varieties, the experiment was a factorial based on a randomized complete block design with four replications that was carried out at the Agricultural Research Station, Zahak, Zabol, Iran in 2010. The experiment consisted of two factors, the first was seed inoculation with fungal species of Glomus mossea mycorrhiza and no inoculation; and the second was four varieties of corn named: SC-770, Tisa, SC-7020 and SC-704. The results showed that application of biological fertilizer mycorrhizal had a significant effect on plant height, flag leaf width, number of grains per ear, 100 seed weight and yield seed ($p \leq 1\%$) and flag leaf length ($p \leq 5\%$). Interaction effects of mycorrhiza × varieties was not significant except for 100 seed weight ($p \leq 1\%$), plant height and yield seed ($p \leq 5\%$).

Key words: Bio-fertilizer, Mycorrhiza, Corn varieties, Yield seed.

INTROUCTION

All plants are somehow associated with the symbiotic relationship mycorrhiza. Since plants are the first producers in the ecosystem, therefore we can conclude that all living organisms from bacteria to humans and ecosystems and all of the dry deserts to moist soils are somewhat dependent on the symbiotic relationship mycorrhiza, the coexistence mycorrhiza is one of the most functional, extensive and important is the symbiotic relationship of the Earth [4,5,16,19,41].

The fungi with uptake of P and other mobile elements such as Cu and Zn can accelerate the growth of plants in corn, soybeans and sorghum [21,3]. Additional application of chemicals such as chemical fertilizers, fungicides and pesticides influences negatively survival and spread of this fungus. It can be said for most of intensive agricultural systems are deprived of the benefits of this symbiosis. The mechanical method is not efficient and economical use of biological methods

to reduce soil compaction, which is environmentally friendly and economically both useful sustainable farming practices are leading to a system [7,35,28]. The fungus can absorb toxic elements, raising EC in the soil and prevent their absorption and other elements, also worthy to mention [33,25].

One the most of important effects of mycorrhiza fungi is to increase crop yield, especially in soils with low fertility. Ortas [31] believes that use of the CGR mycorrhiza fungi and increase the allocation and transfer of materials between roots and stems of the leaves, so that more absorption of nutrients and transfer them to cause an increase in shoot dry weight. The yield increase may be due to the extension of roots, which penetrate through the mycelium of fungi in the soil and crops, access to a greater volume of soil [8], it also increases the tolerance of plant to drought stress [36]. Arbuscular mycorrhizal fungi can control fungal biomass in arable land, where the fungi have an important role on healthy and plant growth [22]. Mycorrhizal arbuscular fungi before dominate the mass fungal in arable land, where the fungi have an important role in the plant growth and health. Mycelium mycorrhizal fungi AM for plant growth are of vital importance [14,13,9].

In addition to the increased absorption of macronutrients, except phosphorus, nitrogen, potassium and magnesium, which is measured [18]. Although the assembly plant to another host can provide multiple benefits, but in some cases this can lead to reduced growth [23]. Arbuscular mycorrhizal fungi may also increase the nitrogen absorbed from plant sources [18]. Although more study is needed to fully understand the mechanisms of this process we discovered [34].

Note that corn used for human food and animal fodder and birds are a mycorrhizal symbiosis, Selecting and applying the most effective method of increasing integration in production can be used. Also the use of systems will coexist environment free from pollution side.

MATERIALS AND METHODS

This experiment was carried out at the Agricultural Research Station of Sistan in 2010. The average annual rainfall was 53 mm with a hot (maximum temperature 47^0 C and minimum temperature 7^0C) and dry climatical condition. Annual means of high, low and average seasonal temperature were recored 34^0C, 8^0C and 24^0C.

The experimental soil was sandy loam. However, soil samples were taken from from a depth of 30-0 cm in order identify physical and chemical properties of soil before planting (Table 1).

Table 1. Properties of the experimental field

pH	EC (ds/m)	Sand (%)	Clay (%)	Silt (%)	Total N (%)	P (ppm)	K (ppm)	Organic C (%)
7.6	2.1	55	14	13	0.03	3.5	110	0.2

A factorial experiment on the basis of a randomized complete block design with four replications was implemented in which inoculated and non-inoculated with mycorrhiza glomus mossea as a factor and four varieties of corn named SC770, SC7020, SC704 and Tisa as the second factor were considered. Mycorrhizal fungi was added to the plots along the planting rows in 3-2 cm apart. Seeds were planted in plots of five rows with a 4 m length, 60 cm between and 15 cm distance within rows.

Before planting, fertilizer nitrogen, potassium sulfate and ammonium phosphate were applied, amounting to 180 and 120 and 150 kg/ha, respectively. In this experiment, morphological traits such as plant height stem diameter, leaf number, flag leaf length, flag leaf width, number of kernels per ear, 100 seed weight, seed protein content were measured.

For statistical data analysis, SPSS 16.0 and MSTATC softwares and for drawing figures a software EXCEL were used. Analysis of variance and mean comparison were used to find significant differences between factors and their levels.

RESULTS AND DISCUSSION

Plant height

In this study, application of mycorrhizal fungi caused significant effect on plant height of corn varieties (Table 2). The mean comparison (Table 3) shows use of mycorrhizal caused the highest plants (166.406) cm in the variety SC770 (Figure 1). Means of plant highet presented the highets height in variety SC770 and lowest in variety SC7020 (Figure 2).

Table 2 - Analysis of variance for morphological and agronomic traits of corn varieties

S.O.V	df	Mean Squares					
		Plant height	Flag leaf length	Flag leaf width	Number of grains per plant	100 seed weight	Yield seed
Block	3	28.841$^{n.s}$	17.119**	0.374$^{n.s}$	9230.698*	12.964*	2.083$^{n.s}$
Variety	3	2444.707**	250.941**	1.851**	27197.698**	11.641$^{n.s}$	236.250**
Mycorrhiza	1	1478.320**	17.258*	2.531**	21788.281**	47.726$^{n.s}$	91.125**
Variety× Mycorrhiza	3	60.172*	1.142$^{n.s}$	0.505$^{n.s}$	4481.031$^{n.s}$	14.760**	6.708$^{n.s}$
Error	21	17.494	2.305	0.253	2697.722	4.229	5.298
%CV		2.62	5.94	11.51	12.19	16.37	7.39

**and ** respectively indicate significant difference at 5% and 1% is likely.*
$^{n.s}$ is non-significant.

Table 3. Mean comparison of mycorrhiza applications, varieties and their interaction effects on morphological and agronomic traits of corn

Traits	Plant height	Flag leaf length	Flag leaf width	Number of grains per plant	100 seed weight	Yield seed
Variety						
V_1	171.400a	25.863b	4.131b	444.875ab	35.750a	12.675ab
V_2	166.425b	23.163c	4.088b	410.875b	34.625a	11.496b
V_3	133.600c	20.075d	4.187b	355.000c	30.375b	11.875b
V_4	167.012b	33.187a	5.088a	493.625a	23.750c	14.219a
Mycorrhiza						
M_1	152.813b	24.838a	4.088b	400.00b	29.438b	11.345b
M_2	166.406a	26.603a	4.650a	452.188a	32.813a	13.788a
Variety×Mycorrhiza						
V_1M_1	162.900c	26.675a	3.700a	402.750a	34.500a	9.912b
V_1M_2	179.900a	25.050a	4.525a	487.000a	37.000a	15.438a
V_2M_1	162.625c	23.600a	3.875a	384.000a	34.000a	10.893b
V_2M_2	170.225b	22.725a	4.300a	437.750a	35.250a	12.100b
V_3M_1	128.375e	20.525a	3.650a	312.000a	27.750a	12.200b
V_3M_2	138.825d	19.625a	4.725a	398.000a	33.000a	11.550b
V_4M_1	157.350c	34.425a	5.125a	501.250a	21.500a	12.375b
V_4M_2	176.675a	31.950a	5.050a	486.000a	26.000a	16.063a

**The same letters in each column show no significant differences at the 5% of probability level.*
Varieties: V_1=SC770 , V_2=Tisa , V_3=7020 , V_4=704
M_1= non-inoculation mycorrhiza, M_2= inoculation mycorrhiza

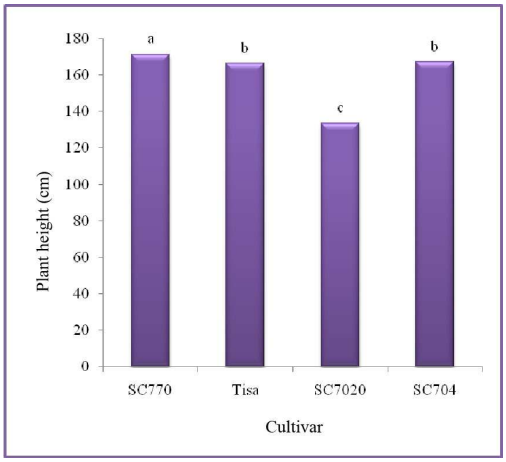

Figure 2 – Means of height in four corn varieties

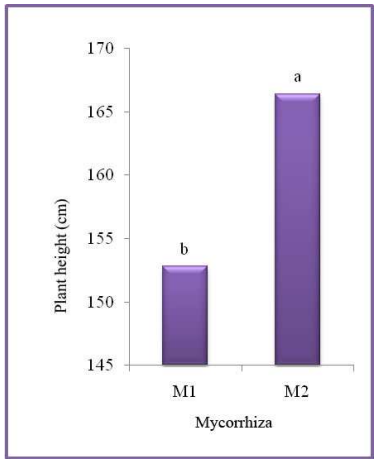

Figure 1 - Effect mycorrhiza application on height of corn varieties

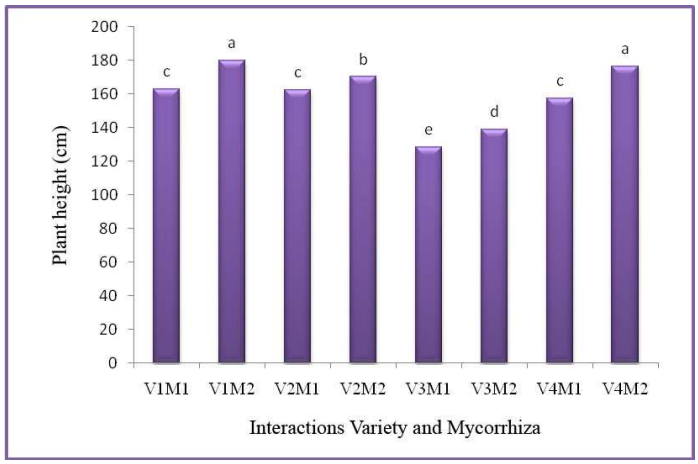

Figure 3 - Means of interaction effects of mycorrhiza and varieties on the height of corn varieties

In general mycorrhizal treatments increased plant height in the four cultivars (Figure 3). General application of mycorrhiza increased plant height compared to treatment is lack of mycorrhiza, Plant height substantially depending on genetic conditions; it also depends on environmental factors [38].

The survey results with other reports in this regard is similar there are a number of reports showing that application of mycorrhiza increased plant height compared to control [1,15,2]. Plant height is partly influenced by environmental conditions [38], this is probably the fungus through the root level contacts with the surrounding environment, causing increased water and nutrient uptake by root increase your plant is in vegetative growth [16,40,17,24,20,37,39].

Flag leaf length

In this experiment, application of mycorrhiza on the flag leaf length was significant, but there was no significant interaction between cultivars and mycorrhizal for this trait (Table 2). Increase of leaf length in the used mycorrhizal plants, including of sorghum as well as by other researchers Panwar [32] and Ojala and Jarrell [30,29] have been reported.

In this experiment had the cultivar SC704 most and cultivar SC7020 lowest flag leaf length (Figure 4). Also application of mycorrhiza to non-increase the length of flag leaf had. (Figure 5).

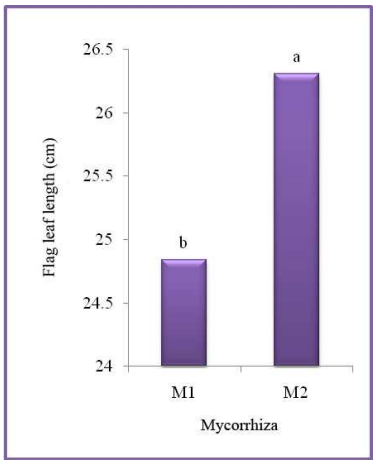

Figure 5 - Effect mycorrhiza application on flag leaf length of corn varieties

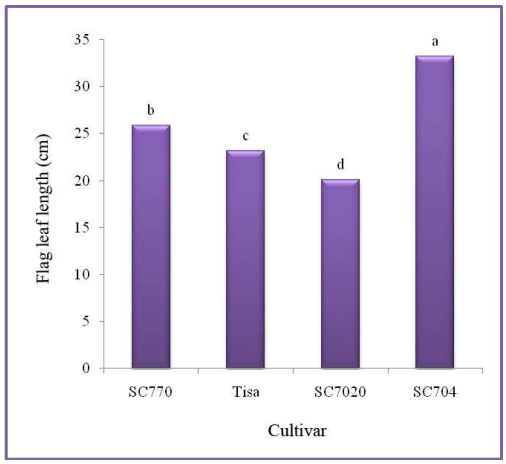

Figure 4- Means of flag leaf length in four corn variety

Flag leaf width

The results (Table 2) effect of mycorrhiza and cultivars studied were significant on flag leaf width (Figure 7) and their interactions Sorghum cultivars with mycorrhiza strains showed no significant difference in terms of impact on this trait [12,25]. It seems to have given cultivars of maize seed have a larger share of asmylat manufacturing their clusters and reproductive organs are taken. Based on the results, was the cultivar SC704 a maximum width of leaves among the cultivars tested (Figure 6).

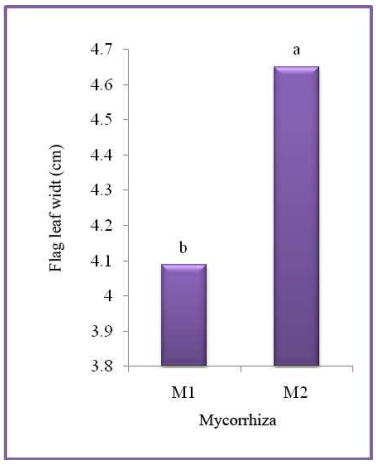

Figure 7 - Effect mycorrhiza application on flag leaf width of corn varieties

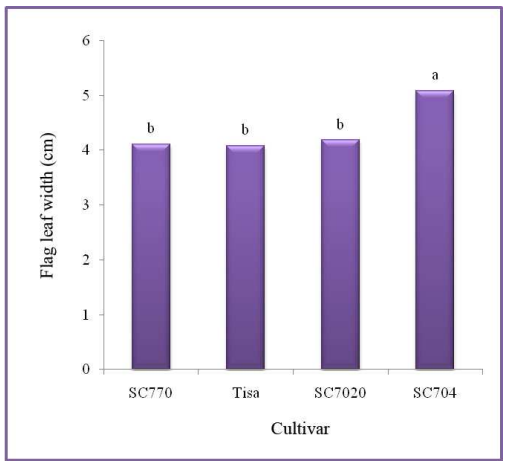

Figure 6 - Means of Flag leaf width in four corn varieties

Number of grains per plant

Analysis of variance showed (Table 2) the main factors of corn varieties, mycorrhiza levels on the number of grains per plant was significant, and effects mycorrhiza on the number of grain per plant was the difference significant not effect on this trait.

The mean comparison disclosed that the highest number of seeds per plant was found for the cultivar SC704 and the lowest for SC7020 cultivar (Figure 8), and the effect of use the mycorrhiza on the grain per plant is the most effective (Figure 9).

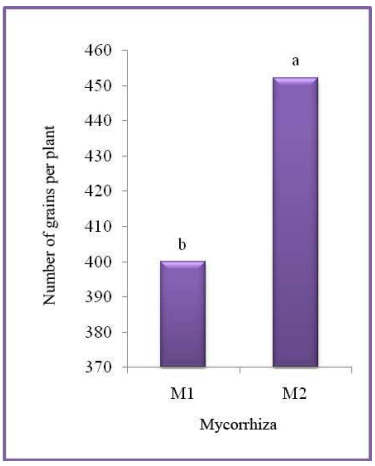

Figure 9 - Effect mycorrhiza application on number of grains per plant of corn varieties

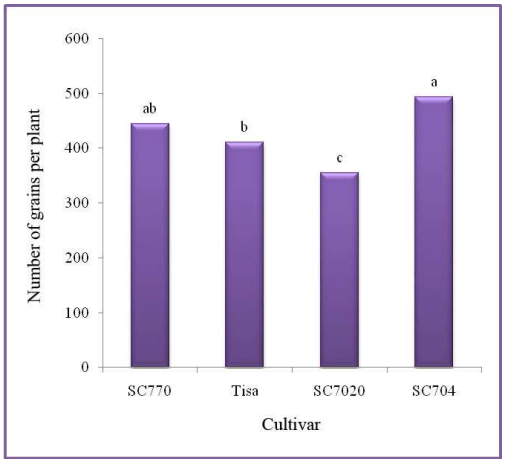

Figure 8 - Means of Number of grains per plant in four corn varieties

100 seed weight

Weigh of 100 grains for different varieties and mycorrhizal treatments were different (Table 2). The interaction effects of cultivars and mycorrhizal on 100 seed weight was not significant. Average comparison showed that the most weight of 100 seed varieties of the SC770 and the Tisa (Figure 10), also the use of mycorrhizal greatest impact on corn was 100 grain weight (Figure 11).

In other reports suggest that the different grains, mycorrhizal symbiosis with 100 seed weight is increased.

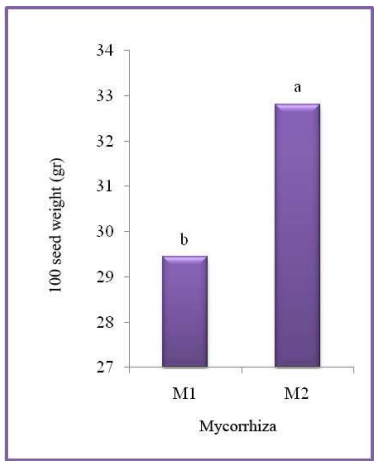

Figure 11 - Effect mycorrhiza application on 100 seed weight of corn varieties

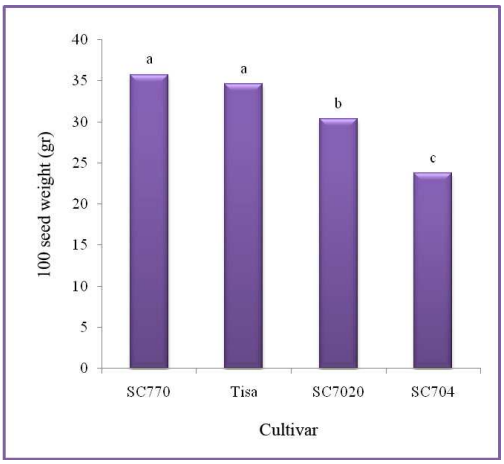

Figure 10 - Means of 100 seed weight in four corn varieties

Reports of other researchers suggest that application of mycorrhiza was increases the yield of corn [6,26,13] and also Idris [19] The increase in yield when using mycorrhizal for sorghum has registered.

Yield seed

Mycorrhizal treatments used in this study left behind a significant effect on corn yield, and while the interactions of cultivars and mycorrhizal showed no significant effect. As can be observed (Table 2), the highest grain yield was related to the cultivar SC -704, also application of mycorrhiza on corn grain yield the greatest impact on the left (Figure 12,13).

This result, with the results of other researchers in relation to increased product is consistent with the use of mycorrhizal fungus[2,5,29].

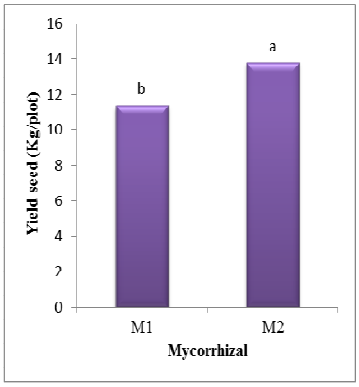

Figure 13 - Effect mycorrhiza application on yield seed of corn

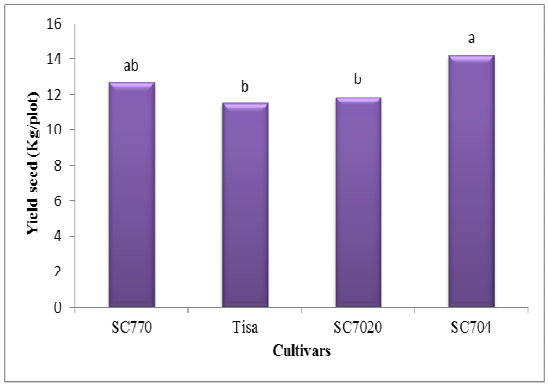

Figure 12 - Means of yield seed in four corn varieties

CONCLUSION

The impact of bio-fertilizers mycorrhizal on 100 seed weight and seed number per ear and grain yield this result is that the successful symbiosis. The varieties SC-704 in the Highest yield with regard to the climatic conditions of the region.

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