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The Effect of Mycorrhiza Fungi (VAM) on Phosphorus Absorption by Corn (*Zea Mays* L.) at South West of Iran

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RESEARCH ARTICLE

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ABSTRACT

In order to understanding of the VAM effects on functions and nutrition of the corn, a research was conducted in Agricultural Research Center of Safi Abad, Khouzestan. The experiment was carried out based randomized complete block design at four replications. The treatments contain Mycorrhiza Fungi and phosphorous includes: A: Phosphorus according to soil test. B: VAM + Phosphorus according to soil test. C: Phosphorus according to 65% of soil test. D: VAM + Phosphorus according to 65% of soil test. E: Check treatment. This research was done to determine amount of absorbed macro and micro nutritious elements in shoot at early growth stage in corn plant. Result showed amounts of absorbed elements in shoot at any of the treatment levels were not different according to the statistical analysis results. Phosphorus content in plant was variable from 0.12 in treatment 5 to 0.18 % in treatment 1. Plant dry matter was variable from 28.60 in treatment 4 to 36.48 gram in treatment 1 and also the yield of fresh plant was variable from 260 in treatment 5 to 320 gram in treatment 2. The treatment caused plant root to be colonized by Mycorrhiza and using phosphorous fertilizer, compared to soil test (check treatment), was the greatest amount of uptake in corn plant.

Keywords: *Maize, Nutrition, Vizicolar Mycorrhiza Arbuscular.*

INTRODUCTION

From evolution view point, one of the factors affecting natural selection is the ability of living beings to survive their generation up to the subsequent reproduction (Sahoo *et al*., 2013). On this basis, mycorrhiza can be considered as a fertilizer that contributes to increase persistent capability in fungi and plant (Asgharzadeh, 2001, Shehata and El-khawas, 2003). Wang *et al*. (2008) have reported that inoculation of *Mycorrhiza arbuscular* L. fungus with cucumber resulted in increased concentration of P, N elements in root and Zn, Cu in stem.

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Gosling *et al*. (2006) showed that in low-phosphorus soil, application of Mycorrhiza fungus results in an increase of phosphorus adsorption as well as high resistance to salinity stress in tomatoes. Fungus and plant root symbiosis cause the increase of the low-mobility elements uptake (Moawad and Maksoud, 1996, Wu and Xia, 2006), particularly phosphorus, absorption of microelements such as Zn, Cu and water uptake. *Mycorrhiza arbuscular*. fungus increases the plant growth through enhancement of photosynthesis, osmotic improvement in salinity and drought conditions stress, and increases drought resistance of the plant (Al-kraki, 2006, Vessey, 2003). Importance of using chemical fertilizers including nitrogen, phosphorus and potash for most crops and reduction essential resources for producing fertilizers, especially phosphorus and increased production costs and over-use of amounts recommended by farmers over past years, have resulted at accumulation this element in most farming lands (Cardoso Irene and Kuyper 2006, Morton *et al*., 2009, Nadian, 1998). About a hundred thousand acres of Khouzestan farming lands are under cultivation of corn annually, giving the largest amount of corn production in this province (Nadian, 1998). Also, phosphorus followed by nitrogen, is the most essential fertilizer required by corn. This research has been done with following aims in order to achieve maximum corn production as well as organic crops: **1**. Investigating the effect of using both chemical and biological Mycorrhiza fertilizers on corn yield. **2**. Studying the possibility of partially replacing biological fertilizer instead of chemical phosphorus in corn.

MATERIALS AND METHODS

Field and Treatment Information

Experiment was conducted in Agricultural Research Center of Safi Abad, Khouzestan (South west of Iran) with latitude 32°15′ northern and longitude 48° 48′ eastern and 115 meters above sea level. This research was carried out as a randomized complete block design with 5 treatments at 4 replications. The treatments included: A: Phosphorus according to soil test. B: VAM + Phosphorus according to soil test. C: Phosphorus according to 65% of soil test. D: VAM + Phosphorus according to 65% of soil test. E: Check treatment.

Crop Management and Traits Measure

A check plot was dedicated as a negative control. In this study all operations of fertilizing and plantation were done manually. The corn hybrid SC.704 was used. The plant spacing was 17 cm and 3 seeds were sown in each hole. In order to apply the treatments on plants, the mycorrihza inoculation fluid which was a mixture of its media together with the segments of mycorrihza roots were put into the hole and then the seeds were sown, and were covered with soil. The amount of used biological fertilizer was determined according to the recommendations of Institute for Soil and Water Investigation that for 30 kg corn seed 100 kg biological Mycorrhiza fertilizer was used. To measure phosphorus in plants, dried plants in oven were ground and one gram of each sample was crushed for 4 hours at temperature 570°C in an electrical furnace. After cooling samples, 10 ml of 2 N chloridric acids was added. Then by adding distilled water, it was reached to 100 ml and was filtered by filter paper. Extracts were used for measuring phosphorus in the soil science lab.

Statistical Analysis

Data were analyzed by MSTATC software and comparing resulted means were conducted by using Duncan's

multiple range tests. The Figures were drawn using the Excel software.

RESULTS AND DISCUSSION

The results showed that the Mycorrhiza fungus by colonizing in the plant's root causes in contributes to increase the weight of dry matter of plant aerial organs. Maximum greatest dry matter weight and percentage of colonized root length belongs to applying the Mycorrhiza for colonizing the corn's root. By nutritional improvement, especially phosphorus, photosynthesis and sap were increased and it increased the dry matter of underground organs. The fresh and dry yield of aerial organs at 7^{th} and 8^{th} leaves: the results of statistical analysis showed that there is a significant difference between various Mycorrhiza levels and phosphorus on the shoot dry weight at 5% level and on shoot fresh weight at 1% level (Table 1).

Table 1. The ANOVA result of treatments on measured traits

S.O.V	df	Shoot fresh weight	Shoot dry weight	Phosphorus uptake (at 7^{th} and 8^{th} leaves)
Replication (R)	3	1.913*	133.931*	0.001*
Treatment (T)	4	41.215*	5397.425**	0.002^{ns}
Error (E)	12	13.095	869.725	0.001
CV. (%)		10.64	9.95	16.91

**, * and ^{ns}: Significant at 1% and 5% probability level, respectively. ns: not significant.

The lowest shoot dry weight was associated with control treatment and the highest was related to the treatment applying Mycorrhiza fungus together with phosphorous (positive treatment) (Fig. 1).

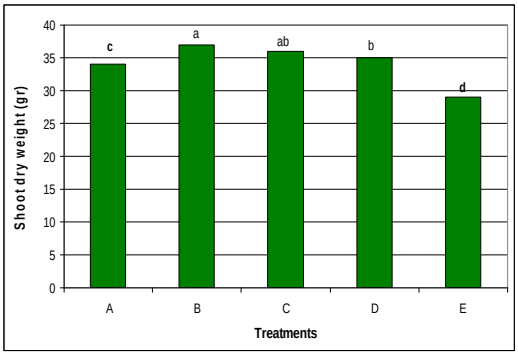

Fig. 1. Effect of treatment on shoot dry weight. (Treatment include: A: Phosphorus according to soil test. B: VAM + Phosphorus according to soil test. C: Phosphorus according to 65% of soil test. D: VAM + Phosphorus according to 65% of soil test. E: Check treatment, Via Duncan test at 5%).

Also similar result happen about shoot fresh weight trait and the lowest amount belonged to control treatment and the highest was related to treatment applying Mycorrhiza fungus together with phosphorous (positive treatment) (Fig. 2).

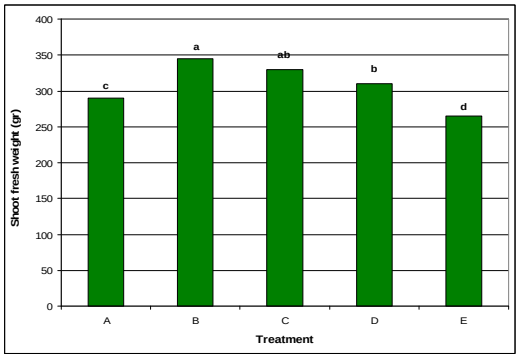

Fig. 2. Effect of treatment on shoot fresh weight. (Treatment include: A: Phosphorus according to soil test. B: VAM + Phosphorus according to soil test. C: Phosphorus according to 65% of soil test. D: VAM + Phosphorus according to 65% of soil test. E: Check treatment, Via Duncan test at 5%).

The increase of shoot dry weight in corn with Mycorrhiza can be attributed to the increase of root length and absorption of more nutrients especially phosphorus. Results obtained by other researchers confirm that application of Mycorrhiza

contributes to more phosphorous adsorption and consequently increased root length results in improvement of plant nutrition and also increase of aerial dry matter weight (Leopold and Ofner, 1991).

The results of statistical analysis about phosphorous uptake by plant at 7th and 8th leaves showed that there is no significant difference between various Mycorrhiza and the adsorbed phosphorus by plant (Table 1). Given the data mean, the largest amount of phosphorus is in the positive control treatment and the lowest is in the negative control treatment (check) (Fig. 3).

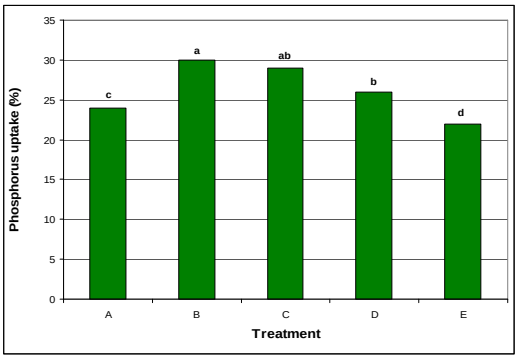

Fig. 3. Effect of treatment on Phosphorus uptake (at 7th and 8th leaves). (Treatment include: A: Phosphorus according to soil test. B: VAM + Phosphorus according to soil test. C: Phosphorus according to 65% of soil test. D: VAM + Phosphorus according to 65% of soil test. E: Check treatment, Via Duncan test at 5%).

CONCLUSION

The application of Mycorrhiza in colonizing the root leads to more adsorption of phosphorus. However, not being significant may be due to inappropriate sampling time presumably early plant growth. Since the sampling was done in the beginning of growth, the root colonization might not be completed. However, it should be noted that in agriculture constantly the numerous factors may affect the plant growth. Thus, it is suggested that this research be continued on the other corn hybrids and even with other species of Mycorrhiza fungi and followed from greenhouse investigation to field study.

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