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Study effect of Mycorrhiza fungi and drought on plant nutrient uptake by green bean

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ABSTRACT: Use of biological fertilizers in agricultural systems are important spatially in promoting sustainable production and maintain soil fertility .To investigate the effect of improving the nutritional status of green bean by mycorrhiza fungi in this study was done a randomized complete block design in a factorial experiment. Drought factor at 3 levels (T0,T1,T2) and Mycorrhiza fungi inoculated at three levels (no inoculation=F0, F1 and F2) in 4 replicates . The medium of loamy sand were used. The results showed that effects of drought stress , mycorrhiza fungi and their interaction on N,P and K was significant. Drought stress had significant effect on phosphorus, potassium and nitrogen concentration. By increasing drought stress from FC (control) to 0.25FC percent field capacity, the content of these elements in leaves tissues were increased. Study Showed that the highest nitrogen treatment was related to T0F2 and Lowest nitrogen treatments to F0T1.The results showed that the highest potassium treatment was related to T2F2 and Lowest treatments to T0F1. The results showed that the highest P treatment was related to T2F1.

***Keywords*:** Green bean, Drought, Mycorrhiza fungi, Biological fertilizers

INTRODUCTION

Use of biological fertilizers in agricultural systems are important spatially in promoting sustainable production and maintain soil fertility. The term of bio-fertilizers and organic materials derived from animal manure, plant residues, green manure, etc., but spatially refers microorganisms, particularly bacteria, fungus of stimulating plant growth of activity of the most important materials, bio-fertilizers(Manaffee & Kloepper, 1994) . Favorable effects on plant growth are well proven by bio-fertilizers (Pan, et al 1999). It groups increase the bioavailability of minerals from the soil through biological nitrogen fixation, soluble phosphorus and potassium and destroy pathogens, affects on hormones and plant growth regulator crop yield (Sturz & Christie, 2003). Considering impact on crop growth, the bacteria are called commonly driving performance (Vessey, 2003, Penmetsa RV,2008). Plants are frequently subjected to different abiotic environmental stresses that determine geographic distribution and adversely affect growth, development, and agronomic yield . Drought is one of the major constraints on plant productivity worldwide and is expected to increase with climatic changes . The symbiotic relationship between microorganism and the roots of higher plants is widespread in nature, and several ecophysiological studies have demonstrated that bio fertilizer are a key component in helping plants to cope with water stress and in increasing drought resistance, as demonstrated in a number of host plant and fungal species (Augé 2001; Ruiz-Lozano 2003; Smith and Read 2008; Ruiz-Lozano and Aroca 1995). The tolerance of plants to drought stress differed with the isolate of Mycorrhiza fungi which the plants were associated. This study was done for understanding effects of two species of Mycorrhiza fungi on plant under drought that can be effective on absorption of nutrients content in green bean plant under drought stress.

MATERIALS AND METHODS

This study was conducted in a greenhouse of Semnan province. This factorial experiment was conducted in a completely randomized design with three replications. Drought treatments consisted of three levels including T0=FC, T1=0.5 FC ,T2=0.25 FC. Mycorrhiza fungi treatments were including two species of bacteria (F1= mosseae Glomus and F2 = Glomus intradices) and control(F0) .The experiment was 4 steps including : 1- preparation of soil samples 2- preparing pots and treatments 3- planting seed 4- adding treatments .The soil samples used for 1 h with a temperature of 121 ° C for 5 min and then rinsed with tap water sterilized pots, were surface sterilized by alcohol. . The research field had a sandy loam soil. The seeds were soaked in 5% bleach for 7 min and were washed 8 to 10 times with distilled water and planted into pots. Arriving the seedling to the next stage were thinned to 3 seedling in per pot. After thinning the seedlings in pots, desired level of stress was done. After about 2 months of planting seeds in every pots shoots of plants were harvested.

RESULTS AND DISCUSSION

RESUALTS

The Analysis of variance of mycorrhiza fungi and drought stress and their interaction on content N ,P and K in green beans was shown in table 2. The results showed that effects of drought stress , mycorrhiza fungi and their interaction on N,P and K was significant. Drought stress had significant effect on phosphorus, potassium and nitrogen concentration. By increasing drought stress from FC (control) to 0.25FC percent field capacity, the content of these elements in leaves tissues were increased. Study showed that the highest nitrogen treatment was related to T0F2 and Lowest nitrogen treatments to F0T1.The results showed that the highest potassium treatment was related to T2F2 and Lowest treatments to T0F1. The results showed that the highest P treatment was related to T2F1 . Table 1. shows anova table of mycorrhiza fungi , drought stress and the interaction on green beans. Table 2. Shows comparison of Mycorrhiza fungi and drought usage on nutrient uptake of plant green beans .

Table 1. The ANOVA Table of mycorrhiza fungi and drought stress and the interaction on green beans

Sources of Variation	Degrees of freedom	% N	% K	% P
Repeat	2	0.009 ns	0.073 ns	0.003 ns
mycorrhiza fungi	2	0.367**	0.393**	0.041**
drought stress	2	0.198**	0.726**	0.046**
mycorrhiza fung* drought stress	4	0.513**	1.656**	0.057**
ERROR	16	0.031	0.042	0.004

Table 2. Table - Comparison of Mycorrhiza fungi and drought usage on nutrient uptake of plant green beans

Sources of Variation	% N	% K	% P
F0 * T0	3.15±0.257 ab	4.277±0.085b	0.083±0.006 c
F0*T1	2.078±0.117d	3.603±0.085d	0.06±0c
F0* T2	2.822±0.023 bc	3.18±0.08e	0.14±0.06bc
T0*F1	2.612±0.28 c	3.01±0e	0.137±0.055 bc
T1*F1	2.931±0.074 abc	3.223±0.125e	0.08±0c
T2*F1	3.132±0.221 ab	3.98±0.04bc	0.46±0.01a
T0*F2	3.242±0.023 a	2.93±0e	0.06±0c
T1*F2	3.15±0.21 ab	3.81±0.55dc	0.24±0.17b
T2*F2	2.87±0.023 bc	4.697±0.255a	0.09±0.03c

***Discussion**:*

The results showed that levels of moderate and severe drought caused a significant reduction in nutrient uptake of N, P and K in green bean plant. fungi mycorrhizal fungi and plant increased crop yield under stress and non-stress conditions . Treatments had higher absorption rate in stress levels than without inoculation.Drought stress had significant effect on phosphorus, potassium and calcium concentration in leaves and flower tissues. By increasing drought stress from fc (control) to 50 percent of field capacity, the content of these elements in leaves were different. Based on the results , drought stress until 70 percent field capacity or 30 percent decreasing in soil moisture, had not reduced flower yield and the concentration of nutrient elements in leaves and flower of borage plant (M. Heidari1 and A. Minaei2014). Mycorrhizal fungi had a good effect on phosphorus and potassium in plant understress . Symbiosis has a variety of effects on the defensive responses of host plants, depending on the species of host plant and the AM fungus involved (Bezemer and van Dam 2005).To summarize, mycorrhizal plants employ various protective mechanisms to counteract drought stress. Considerable progress has been made in understanding the role of AM symbiosis in conferring drought resistance to plants, but different aspects still require attention for unraveling novel metabolites and hidden meta- bolic pathways. The accumulated physiological, biochemical, and molecular data based on classical approaches will benefit from the various 'omic' techniques and their combinations. An in-depth investigation using the advanced methodologies could help to the mechanisms of drought avoidance and/or tolerance induced by AM symbiosis and to discriminate the drought-induced processes of the protective mechanisms regulated by AM symbiosis.

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