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Research Article

Effect of Nitrogen Fertilizer and Mycorrhizal Fungi on Yield and Yield Components of Wheat

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ABSTRACT

Nitrogen (N) is one of the critical nutrients for crop production and is generally applied in large quantities in form of fertilizer to soils. However, most plants only utilize less than one-half of fertilizer N applied, and the loss of fertilizer N was high. Wheat is the most important agricultural good in international market and also it is one of the strategic agricultural productions which have daily and universal consumption. Wheat production in Mediterranean region is often limited by sub-optimal moisture conditions. In general, phosphatic fertilizers are recommended to be broadcasted and incorporated into soil before sowing. The average recovery of phosphorus fertilizer by crops is very low and varies from 15-20% on single crop basis. The field experiment was laid out factorial with randomized complete block design with three replications. Treatments included mycorrhiza in two level (No inoculated mycorrhiza (a1) and inoculated mycorrhiza (a2)), Nitrogen fertilizer (Control (b1), 50 kg/ha (b2) and 150 kg/ha (b3)) and phosphorus fertilizer (control (c1), 50 kg/ha (c2) and 100 kg/ha (c3)). Analysis of variance showed that the effect of mycorrhiza, nitrogen and phosphorus fertilizer on all characteristics was significant.

Key words: Mycorrhiza, Nitrogen, Phosphorus, Wheat

INTRODUCTION

Analysis of crop development basis on incremental distinct events, namely Pheno stage Such as seedling emergence, Flower initiation and emergence of flower will be easier the flowers will be easier. Nitrogen (N) is one of the critical nutrients for crop production and is generally applied in large quantities in form of fertilizer to soils (Malhia *et al*., 2001; Murshedul *et al*., 2006; Singh *et al*., 2007; Kong *et al*., 2008). However, most plants only utilize less than one-half of fertilizer N applied, and the loss of fertilizer N was high (Zhu, 2000; Zhu and Chen, 2002). Nitrogen management in agro-ecosystems has been extensively studied due to its importance in improving crop yield and quality, and in mitigating the negative effects of fertilizer N losses such as nitrate contamination of groundwater, eutrophication of surface water, and greenhouse effect (Hillin and Hudak, 2003; De Paz and Ramos, 2004; Alam *et al*., 2006; Dambreville *et al*., 2008). Soil exchangeable inorganic N is the common source of various N losses (Zhu, 2000), whereas the immobilization and release of fertilizer N in soil organic N and fixed NH4+ pools are important processes regulating fertilizer N transformation in soil, and play an important role in controlling soil Potential supply (Mubarak *et al*., 2001). Therefore, a key challenge in minimizing loss of chemical fertilizer N is how to decrease the superfluous accumulation of soil exchangeable inorganic N, accelerate its transformation to other N forms (such as organic N and fixed NH^{4+}), and synchronize the supply of available N with plant uptake during peak periods of crop N demand (Zhu, 2000; Lin *et al*., 2007). Understanding the accumulation of fertilizer N in soil inorganic N pool under different fertilization practices is of considerable importance in developing proper fertilization practice for minimizing fertilizer N loss while maximizing its use efficiency (Lu *et al*., 2008). Wheat is the most important agricultural good in international market and also it is one of the strategic agricultural productions which have daily and universal consumption (Mollasadeghi *et al*., 2011). Wheat production in Mediterranean region is often limited by sub-optimal moisture conditions. Visible syndromes of plant exposure to drought in the vegetative phase are leaf wilting, a decrease in plant height, number and area of leaves and delay in accuracy of buds and flowers

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(Gholamin *et al*., 2010), almost 32% of wheat culture face up to various types of drought stress during the growth season in developing Countries (Shamsi, 2010). In general, phosphatic fertilizers are recommended to be broadcasted and incorporated into soil before sowing (Malik, 1992). The average recovery of phosphorus fertilizer by crops is very low and varies from 15-20% on single crop basis (Rashid, 1994). This may be attributed to reversion of applied phosphates to less available forms such as octa calcium phosphates, carbonate apatite, hydroxy apatite and flour apatite by reacting with clays and calcium compounds (Tisdale *et al*., 1985). According to Rashid and Din (1993), degree of phosphorus fixation depends on the ratio of applied phosphorus, the fixation of broadcasted phosphorus is much greater than the phosphorus applied through bands. Fertigation is a technique that involves application of plant nutrients through irrigation. It is an effective means of placement of fertilizers and improving fertilizer use efficiency (Latif and Iqbal, 2001). Latif *et al*., (1994) also reported that solution of phosphate fertilizer applied along with the first irrigation produced wheat grain yield equivalent to conventional soil mixing before sowing or top dressing after plant emergence.

MATERIALS AND METHODS

Location of experiment

The experiment was conducted at the zahak which is situated between 31° North latitude and 61° East longitude.

Composite soil sampling

Composite soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics.

Field experiment

The field experiment was laid out factorial with randomized complete block design with three replications.

Treatments

Treatments included mycorrhiza in two level (No inoculated mycorrhiza (a1) and inoculated mycorrhiza (a2)), Nitrogen fertilizer (Control (b1), 50 kg/ha (b2) and 150 kg/ha (b3)) and phosphorus fertilizer (control (c1), 50 kg/ha (c2) and 100 kg/ha (c3)).

Data collect

Data collected were subjected to statistical analysis by using a computer program MSTATC. Least Significant Difference test (LSD) at 5 % probability level was applied to compare the differences among treatments` means.

RESULTS AND DISCUSSION

Biological yield

Analysis of variance showed that the effect of mycorrhiza on harvest index was significant (Table 1). The maximum of harvest index of treatments inoculated mycorrhiza was obtained (Table 2). The minimum of harvest index of treatments No inoculated was obtained (Table 2). Analysis of variance showed that the effect of nitrogen fertilizer on harvest index was significant was significant (Table 1). The maximum of harvest index of treatments 150 kg/ha was obtained (Table 2). The minimum of harvest index of treatments control was obtained (Table 2). Analysis of variance showed that the effect of phosphorus fertilizer on harvest index was significant was significant (Table 1). The maximum of harvest index of treatments 100 kg/ha was obtained (Table 2). The minimum of harvest index of treatments control was obtained (Table 2).

Grain yield

Analysis of variance showed that the effect of mycorrhiza on grain yield was significant (Table 1). The maximum of grain yield of treatments inoculated mycorrhiza was obtained (Table 2). The minimum of grain yield of treatments no inoculated was obtained (Table 2). Analysis of variance showed that the effect of nitrogen fertilizer on grain yield was significant was significant (Table 1). The maximum of grain yield of treatments 150 kg/ha was obtained (Table 2). The minimum of grain yield of treatments control was obtained (Table 2). Analysis of variance showed that the effect of phosphorus fertilizer on grain yield was significant was significant (Table 1). The maximum of grain yield of treatments 100 kg/ha was obtained (Table 2). The minimum of grain yield of treatments control was obtained (Table 2).

Biological yield

Analysis of variance showed that the effect of mycorrhiza on biological yield was significant (Table 1). The maximum of biological yield of treatments inoculated mycorrhiza was obtained (Table 2). The minimum of biological yield of treatments no inoculated was obtained (Table 2). Analysis of variance showed that the effect of nitrogen fertilizer on biological yield was significant was significant (Table 1). The maximum of biological yield of treatments 150 kg/ha was obtained (Table 2). The minimum

Table 1: Anova analysis of the wheat affected by nitrogen, phosphorus fertilizer and mycorrhizal fungi

Sov	df	Harvest index	Grain yield	Biological yield	Plant height
R	2	22.63	9303.01	101890.7	20.51
Mycorrhiza (a)	1	895.6**	424358.6**	1003140.7**	1441.50**
Nitrogen fertilizer (b)	2	716.4**	417047.9**	462535.1**	771.12**
phosphorus fertilizer (c)	2	687.7**	128824.7*	492035.1**	555.57*
a*b	2	119.4*	101543.6*	81446.2^{ns}	522.05*
a*c	2	294.2**	577451.3**	46568.5^{ns}	231.50^{ns}
b*c	4	539.1**	492533.8**	594757.4**	151.40^{ns}
a*b*c	4	569.7**	606650.2**	549190.7**	104.55^{ns}
Error	34	31.35	26860.7	61171.1	139.53
CV	-	11.24	8.08	6.16	12.50

*, **, ns: significant at P<0.05 and P<0.01 and non-significant, respectively.

Table 2: Comparison of different traits affected by nitrogen, phosphorus fertilizer and mycorrhizal fungi

Treatment	Harvest index	Grain yield	Biological yield	Plant height
Mycorrhiza				
No inoculated	45.7b	1938.5b	3877.7b	89.25b
Inoculated mycorrhiza	53.85a	2115.8a	4150.3a	99.59a
Nitrogen fertilizer				
Control	43.2c	1873.6c	3912.7b	90b
50 kg/ha	50.36b	2030.1b	3930.5b	91.33b
150 kg/ha	55.77a	2178a	4198.8a	101.94a
phosphorus fertilizer				
control	43.61c	1954.3b	3862.7b	88.88b
50 kg/ha	49.75b	2007.3b	3988.8b	94.38ab
100 kg/ha	55.97a	2120a	4190.5a	100a

*, **, ns: significant at P<0.05 and P<0.01 and non-significant, respectively.

minimum of biological yield of treatments control was obtained (Table 2). Analysis of variance showed that the effect of phosphorus fertilizer on biological yield was significant was significant (Table 1). The maximum of biological yield of treatments 100 kg/ha was obtained (Table 2). The minimum of biological yield of treatments control was obtained (Table 2).

Plant height

Analysis of variance showed that the effect of mycorrhiza on plant height was significant (Table 1). The maximum of plant height of treatments inoculated mycorrhiza was obtained (Table 2). The minimum of plant height of treatments no inoculated was obtained (Table 2). Analysis of variance showed that the effect of nitrogen fertilizer on plant height was significant was significant (Table 1). The maximum of plant height of treatments 150 kg/ha was obtained (Table 2). The minimum of plant height of treatments control was obtained (Table 2). Analysis of variance showed that the effect of phosphorus fertilizer on plant height was significant was significant (Table 1). The maximum of plant height of treatments 100 kg/ha was obtained (Table 2). The minimum of plant height of treatments control was obtained (Table 2).

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