INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print) 2222-5234 (Online)
http://www.innspub.net
Vol. 5, No. 10, p. 111-118, 2014

RESEARCH PAPER OPEN ACCESS

Effect of mycorrhiza fungi on percent of protein, plant height, dry weight, number of panicles in *Triticum aestivum*

Hossein Badie Barzin, Mahdiyeh Fadai Rayni, Alireza Sobhkhizi, Mohsen Noori*

Higher Educational Complex of Saravan, Iran

Key words: Dry weight, Number of panicles per plant, Protein, Plant height.

http://dx.doi.org/10.12692/ijb/5.10.111-118 Article published on November 26, 2014

Abstract

Wheat (*Triticum aestivum* L.) is one of the important staple food and widely cultivated leading cereals crop both in acreage and in production among the grain crops of the world. Fertilizers are major factors in maintaining soil fertility, but Using too much of them, especially when dealing with poor management practices such as burning crop residues combined to greatly reduce the amount of soil organic matter. Economic problems arising from growing increased use of chemical fertilizers on the one hand and environmental issues associated with non-normative use of these fertilizers such as environmental pollution, loss of soil fertility and reduce the value of quality herbal products, On the other hand, has resulted in greater attention to biological fertilizers. In this study, research crops planted in 2011, and Khash mountain stage carried the gem industry. The soil of the experimental site belonging loam. Composite soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics. Analysis of variance showed that the effect of mycorrhiza and Nitrogen on all characteristics was significant

* **Corresponding Author:** Mohsen Noori ✉ 1366.nouri@gmail.com

Introduction

Wheat (*Triticum aestivum* L.) is one of the important staple food and widely cultivated leading cereals crop both in acreage and in production among the grain crops of the world. More than one-third of the world. Population is feed by wheat. Wheat is the major crop in Iran (Keshavars *et al.*, 2003). It is cultivated over a wide range of environments, because of wide adaptation to diverse environmental conditions. In Iran, 6.2 million hectares are under wheat cultivation, of which 33% is irrigated and 67% is rain fed, the irrigated wheat growing areas (2 million hectares) are located mostly in southern, central and eastern of Iran (Keshavars *et al.*, 2003). Fertilizers are major factors in maintaining soil fertility, but Using too much of them, especially when dealing with poor management practices such as burning crop residues combined to greatly reduce the amount of soil organic matter.

This issue features can effects on the physical, chemical and biological soil features and the soil increases soil erosions in these soil (Chandraskar, 2005). Economic problems arising from growing increased use of chemical fertilizers on the one hand and environmental issues associated with non-normative use of these fertilizers such as environmental pollution, loss of soil fertility and reduce the value of quality herbal products, On the other hand, has resulted in greater attention to biological fertilizers (Dobereiner *et al*, 2007). One biological way to increase the productivity in the agricultural sector is the effective use of beneficial microorganisms in the soil that have the ability to enhance plant growth and yield. In fact, bio fertilizers are said to be fertilizer material that contains a sufficient number of one or more species of soil organisms and supply the appropriate preservatives (Davarinejad *et al*, 2004).

Add organic matter of soil to provide the greatest plant needs is one of the benefits of this type of fertilizers. In addition, the supply of nutrients to be fully compatible with the natural power of plants ,help to biodiversity, intensification of vital activities, improve the quality and keeping health of the environment is one of the most important biological advantages (Novell leyva *et al*, 2003).

Haloi (1980) reported that when initial P deficiency symptoms appeared 25 days after sowing in wheat, higher doses of ammonium phosphate as a foliar spray gave the greatest reduction in P deficiency and highest yields. Foliar fertilization with nitrogen, phosphorus, and potassium (N-P-K) can be supplemented with soil applied fertilizers but cannot replace soil fertilization in the case of maize (Ling and Silberush, 2002), because demand for P is 1/10 that of N hence, a foliar application might be beneficial. Therefore, correcting the plant's deficiency by foliar application seems plausible. Very little research has been conducted on the use of P as foliar spray at early stages of wheat and corn. However, recent work by Benbella and Paulsen (1998) showed that foliar applications after anthesis of 5 to 10 kg $KH2PO4$ ha^{-1} (1.1 to 2.2 kg P ha^{-1}) increased wheat grain yields by up to 1 Mg ha^{-1}. Wheat grain yields are hindered due to senescence of wheat during grain fill. Therefore, to effectively prolong senescence, P has to be applied during later stages of growth, which is why foliar application seems particularly promising (Benbella and Paulsen, 1998). Elliott *et al.* (1997) reported a critical P concentration of 0.19 to 0.23% (at 90% maximum grain yield) in wheat grain. Earlier, Bolland and Paynter (1994) reported that critical P concentration in wheat decreased from 0.91% to 0.23% (in shoot) with the growing season and 0.27% in grain.

Mycorrhizal fungi are generally considered mutualistic and there has been little concern over potential negative consequences of their introduction in soils. Nevertheless evidence is growing that mycorrhizal function can range from mutualistic to parasitic (Klironomos, 2003) with host plant communities and edaphic conditions. Inoculation by non-native strains of AM fungi as bio-fertilizer is being promoted without clear evidence for symbiotic effectiveness and fungal persistence in field conditions. Justifiable investment for delivering artificially propagated AM fungal inoculants only has potential while it enhances crop yields and the introduced AMF persist among indigenous mycorrhizal fungal field populations without disturbance over a period of time. Phosphate fertilizers are the most important fertilizers. Phosphorus and nitrogen are the main elements required by plants and are the most widely used elements of seed development and growth, that has a basic effect in the form of the seed and are found plenty of fruits and seeds (Malekooti, 2000).

The efficiency of basal and/or foliar application of P was found to be similar (Singh *et al.*, 1981). P for interaction increases the efficiency and effectiveness of N, phosphorus made crop resistance to disease, as well as is control the negative impact of frequency N (Mousavi jangali *et al*, 2004). Phosphate solubilizing bacteria are able change insoluble phosphorus in soil into the absorbed soluble form. Fluorescent Pseudomonas (fluoresces and putida species) are the most important type of PGPR. These bacteria contribute to better plant growth either directly, ie plant growth through nutritional and physiological mechanisms, such as production of plant hormones, solvers phosphate, accelerate the mineralization process, or indirectly.

Control of pathogens through the production of compounds such as cyanide, siderophore, antibiotics and antifungal metabolites (Reyhanitabar *et al*, 2002). Grains has most needed to fertilizers, then, the use of biological products for feed grains, seem to be one of the key solutions to enhance performance, improve product quality, food security, sustainable production and community health promotion in production of products without chemical pesticides (Karimiyan, 1998).

In notice of role of motive of growth bacteria in provide of useful elements such as phosphorus, reducing environmental pollution and its undeniable role in sustainable agriculture, were implemented this study about the effect of combined application of chemical fertilizers and on solubilizing bacteria yield and yield components and fertilizer use efficiency of maize in climate Dehloran one of Ilam functions with the following objectives. Study the possibility of using bio-fertilizer as a way to increase the solubility and absorption of phosphate fertilizers. Khattak and Bhatti (1986) conducted research work on the residual effect of phosphorus and potassium on the yield of maize and wheat.

They found that P applied to the first crop was sufficient for the subsequent second and third crop. Potassium applied to the first crop may be sufficient up to fourth or even fifth crop.

Material and methods

Location of experiment

In this study, research crops planted in 2011, and Khash mountain stage carried the gem industry.

Composite soil sampling

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

Field experiment

This study is a factorial experiment in a randomized complete block design with three replicates and all experiments were performed with different levels.

Treatments

In this experiment, a variety of wheat called clear that improved cultivars were used. Mycorrhiza arbuscular fungi (AM) in both the inoculated and non-inoculated with three levels of nitrogen and phosphorus fertilizer in three levels as other experimental treatments were used. Urea nitrogen is used by organizations of agricultural support services were provided. The farm has been in previous years under fallow land preparation including plowing, disk loader and fustigation is. The plowing by moldboard plow to a depth of 30 cm was used. The operation of the disc, the disc plow was perpendicular offset to a depth of 15 cm. To soil and plant nutrient land of the amount needed according to soil test results fustigation was done. To measure this trait after five plants were randomly selected and harvested from the middle two lines by removing the border took place clusters of each of the plant to seed removed separately the for the plant out and counting were recorded.

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

Number of panicles per plant

Analysis of variance showed that the effect of mycorrhiza and Nitrogen on number of panicles per plant was significant (Table 1). The maximum of number of panicles per plant (10.96) by inoculated of mycorrhiza was obtained (Table 2). The minimum of number of panicles per plant (6.4) by non-inoculated was obtained. Analysis of variance showed that the effect of Phosphorus on number of panicles per plant was not significant (Table 1). Foliar fertilization with nitrogen, phosphorus, and potassium (N-P-K) can be supplemented with soil applied fertilizers but cannot replace soil fertilization in the case of maize (Ling and Silberush, 2002), because demand for P is 1/10 that of N hence, a foliar application might be beneficial. Therefore, correcting the plant's deficiency by foliar application seems plausible.

Table 1. Anova analysis of the wheat affected by interactions of mycorrhiza in phosphorus in nitrogen.

S.O.V	df	Number of panicles per plant	Protein (%)	Dry weight	Plant height
R	2	8.01	0.59	149.1	18.66
Mycorrhiza (M)	2	35.63**	5.22**	582.5*	1.50
N	2	24.74*	1.15**	930.46*	38.50*
P	2	7.18	0.3	231.9	34.56*
M*N	2	39.40**	649*.0	695.01*	33.58*
M*P	2	12.74	0.281	598.07*	18.2
M*N*P	4	13.4	0.06	703.8*	34.42*
N*P	4	8.43	0.144	643.21*	94.30**
C.V	34	7.17	0.221	185.4	10.5

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

P: Phosphorus, M: Mycorrhiza, N:Nitrogen.

Table 2. Mean comparison of different characteristics influenced by mycorrhiza in phosphorus in nitrogen interactions.

	Mean-square			
	Number of panicles per plant	Protein (%)	Dry weight	Plant height
Mycorrhiza				
inoculated	10.96	15.5	601.8	95.7
Non-inoculated	6.4	14.15	759.07	95.4
Nitrogen				
0 kg	7.11b	14.8 b	670.16 b	90.9 c
50 kg	9b	14.86 b	681.27 b	95.11 b
100 kg	10a	15.58 a	714.3 a	106.7 a
Phosphorus				
0 kg	8	14.73	677.3	90.6 c
50 kg	8.8	14.98	688.3	96.6 b
100 kg	9.2	14.82	700.05	99.6 a

Any two means not sharing a common letter differ significantly from each other at 5% probability.

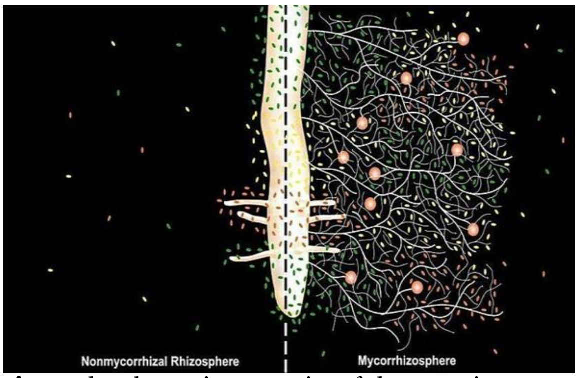

Fig 1. The absorption capacity of the roots increases by as much as 700% for this reason. It is much easier for the plants to absorb nutrients and water. And, just as important: the beneficial fungi and soil bacteria occupy the space around the roots so that pathogens have much fewer opportunities. Some fungi even actively kill nematodes.

Fig 2. Mycorrhizal fungi seen through a microscope

Add organic matter of soil to provide the greatest plant needs is one of the benefits of this type of fertilizers. In addition, the supply of nutrients to be fully compatible with the natural power of plants ,help to biodiversity, intensification of vital activities, improve the quality and keeping health of the environment is one of the most important biological advantages (Novell leyva *et al*, 2003).

Protein (%)

Analysis of variance showed that the effect of mycorrhiza and Nitrogen on protein was significant (Table 1). The maximum of protein (15.58) by 100kg nitrogen was obtained (Table 2). The minimum of number of protein (14.15) by non-inoculated was obtained. Analysis of variance showed that the effect of Phosphorus on number of panicles per plant was not significant (Table 1). Khattak and Bhatti (1986) conducted research work on the residual effect of phosphorus and potassium on the yield of maize and wheat. They found that P applied to the first crop was sufficient for the subsequent second and third crop. Potassium applied to the first crop may be sufficient up to fourth or even fifth crop.

Fig 3. Mycorrhizal fungi populate the area around a plant's roots and form very thin filaments, adding to the length and efficiency of a plant's roots. This is like having a second set of roots for the plants.

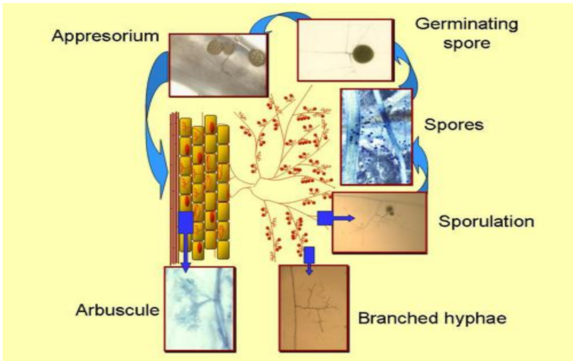

Fig 4. The life cycle of an Arbuscular mycorrhizal fungus. The germination and hyphal growth from asexual spores in the soil is stimulated by signaling compounds released by roots (top right). These hyphae form infection structures (appresoria) on the surface of host roots the fungus grows into the root forming hyphae between cells and arbuscules that penetrate cell walls without killing the plant cells. Hyphae also grow out into the soil forming a branched mycelium that functions to explore the soil and take up mineral nutrients. Spores are formed by this external mycelium, completing the life cycle.

Dry weight

Analysis of variance showed that the effect of mycorrhiza and Nitrogen on dry weight was significant (Table 1). The maximum of dry weight

(759.07) by non-inoculated was obtained (Table 2). The minimum of dry weight (601.8) by inoculated was obtained. Analysis of variance showed that the effect of Phosphorus on dry weight was not significant (Table 1). Grains has most needed to fertilizers, then, the use of biological products for feed grains, seem to be one of the key solutions to enhance performance, improve product quality, food security, sustainable production and community health promotion in production of products without chemical pesticides (Karimiyan, 1998). In notice of role of motive of growth bacteria in provide of useful elements such as phosphorus, reducing environmental pollution and its undeniable role in sustainable agriculture, were implemented this study about the effect of combined application of chemical fertilizers and on solubilizing bacteria yield and yield components and fertilizer use efficiency of maize in climate Dehloran one of Ilam functions with the following objectives.

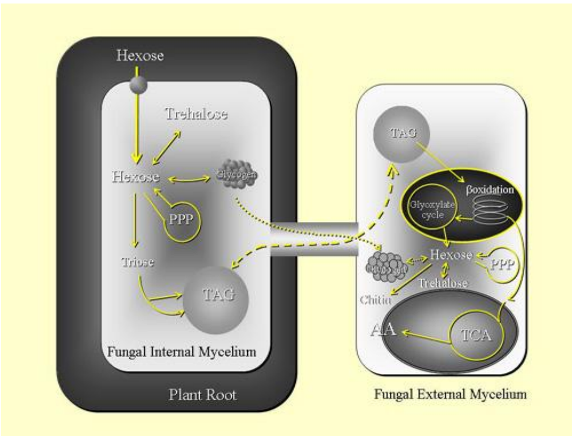

Fig. 5. The movement of carbon in the AM symbiosis. We have used stable isotopic labeling experiments supported by gene expression and microscopy measurements to elucidate the processes shown above. Carbon is transferred from the plant to the fungus inside the roots as hexose and this is made into short term fungal storage carbohydrates (glycogen and trehalose). The fungus makes triacylglycerol (TAG) in the root which is exported within the fungus to the external mycelium and to fungal mycelium in other roots (but carbon is not transferred to roots). TAG is broken down in the external mycelium and the glyoxylate cycle is used to produce storage and structural carbohydrates (cell walls) as well as energy via the TCA cycle and other products including amino acids (AA).

Fig. 6. Mycorrhizae reduce the use of tilling, irrigation and chemical inputs in aggriculture. It also helps sequester carbon and is a key environmental relationship in our survival on the planet. Many organic farmers who use mycorrhizal fungi never have to water their crops even during drought. You can see several of these side-by-side comparisons pictured here online that illustrate exactly why.

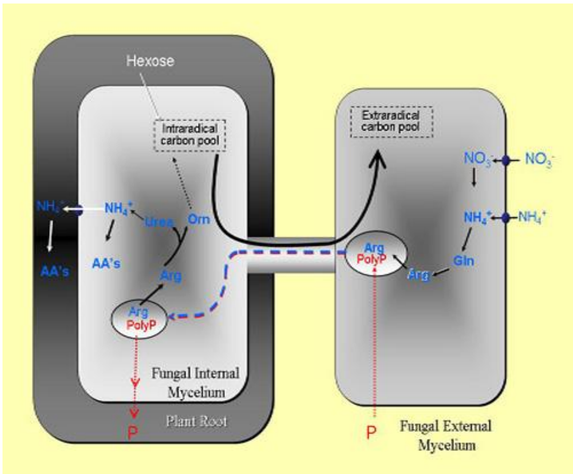

Fig. 7. The movement of Nitrogen in the AM symbiosis. Based on previous work we proposed the scheme shown here by which nitrogen moves from soil to plant via arbuscular mycorrhizal fungi (Bago *et al* 2001). We subsequently provided evidence from labeling and gene expression that this is how N moves through the symbiosis (Govindarajulu *et al* 2005; Jin *et al* 2005). Inorganic N (NO3- and NH4+) is taken up by the external mycelium, assimilated and converted to arginine, which is transported (probably in association with Polyphosphate) within the fungus to the fungal mycelium inside plant roots. There the arginine is broken down to release ammonium which

is transferred to the plant without carbon. More recently we have identified most of the fungal metabolic genes involved in N movement and begun to characterize the regulation of the pathway.

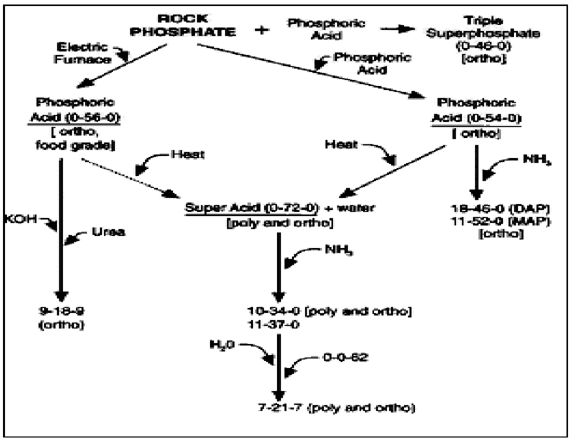

Fig. 8. The process used in the manufacture of various phosphate fertilizers.

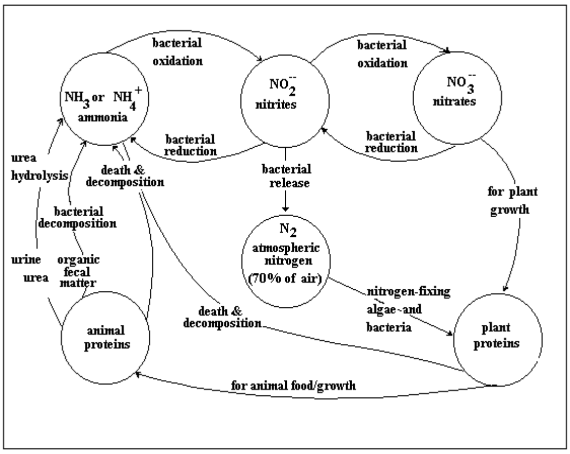

Fig. 9. The nitrogen cycle diagram best illustrates the relationships that exist among the various forms of nitrogenous compounds and the changes that occur in nature. The atmosphere serves as the reservoir for the nitrogen from which nitrogen is constantly removed by the action of lightning and certain nitrogen-fixing bacteria and algae. As you can see from the nitrogen cycle figure, nitrogen is converted into plant protein organic nitrogen. This means that nitrogen is one of the many elements that make up protein. From here it can be converted into animal protein organic nitrogen. Animals give off waste material, urine and fecal matter, both of which contain organic nitrogen forms. For example, fish release ammonia from their gills. Plant tissues are the only source of nitrogen for animals.

Plant height

Analysis of variance showed that the effect of mycorrhiza and Nitrogen on Plant height was significant (Table 1). The maximum of Plant height (106.7) by 100 kg nitrogen was obtained (Table 2). The minimum of Plant height (90.6) by non-phosphorus was obtained. Analysis of variance showed that the effect of Phosphorus on Plant height was significant (Table 1). Elliott *et al.* (1997) reported a critical P concentration of 0.19 to 0.23% (at 90% maximum grain yield) in wheat grain. Earlier, Bolland and Paynter (1994) reported that critical P concentration in wheat decreased from 0.91% to 0.23% (in shoot) with the growing season and 0.27% in grain. Mycorrhizal fungi are generally considered mutualistic and there has been little concern over potential negative consequences of their introduction in soils.

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