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EFFECT OF SOME BIO-FERTILIZERS AS INDIRECT ENERGY ON YIELD AND YIELD COMPONENTS WHEAT (*TRITICUMAESTIVUM* L.)

ABASALTROSTAMI AJIRLOO[1], VAHID ASHRAFI[2], MOHADESE AHMADVAND[3], HOORIEH POURBOZORG[2], MINA DAVARAN[4], MORAD SHAABAN[5*] AND ZAHRA RAHMATI MOTLAGH[5]

1-Young Researchers and Elite Club, Parsabad Branch, Islamic Azad University, Parsabad, Iran

2-Young Researchers and Elite Club, Tabriz Branch, Islamic Azad University, Tabriz, Iran

3- M.Sc student of agricultural mechanization, Bu-Alisina University, Hamedan, Iran

4- Payamenoor University, Germi center, Germi, Iran

5-Young Researchers and Elite Club, Boroujed Branch, Islamic Azad University, Boroujerd, Iran

ABSTRACT

A field experiment was laid out in order to study on effect of different Bio fertilizers as indirect energy on yield and yield components of wheat (*triticumaestivum* L. cv. Koohdasht) at 2014 growing season. The experiment was laid out in a factorial design based on randomized block design with three replications. Treatments were Nitrogen bio-fertilizers in three levels (Azot barvar2, Nitrokara and Nitroxin) and phosphorbiofertilizer in three levels (Bio-phosphor, Phosphate Barbar2 and Biozar).Analysis of variance results showed that effect of different N and P biofertilizersand interaction between them were significant on all treats.Based on the results, combined application of N and P bio-fertilizer has a better effect on yield and yield components of wheat rather than single application of them due to synergistic effect between them. Therefore, we can conclude that combined application of these fertilizers had more efficiency because of some positive interaction between their microorganisms in soil that result to synergistic effect and laid to increase in yield components and in final grain yield. In final our results indicated that higher grain yield observed in combined application of Phosphate Barvar 2

with Azot barvar2. Application of combined fertilizer is better for farmer in wheat field of Oshtorinan region for high yield and economic benefits in wheat.

Keywords: Biological fertilizer, yield components and wheat

INTRODUCTION

Biological fertilizers are the newest and most technically advanced way of supplying mineral nutrients to crops. Compared to chemical fertilizers, their supply nutrient for plant needs, minimizes leaching, and therefore improves fertilizer use efficiency (Subbarao*et al*, 2013). Bio-fertilizers have a positive effect on growth, yield and yield component of many crops. Fertilizer management is one of the most important factors in successful cultivation of crops affecting yield quality and quantity (Tahmasbi et al, 2011). Overuse of different chemical fertilizers is one of the causes for the degradation of environment and soil. Bio-fertilizers include mainly the nitrogen fixing, phosphate solubilizing and plant growth promoting microorganisms (Goel*et al*, 1999) providing a more balanced nutrition for plants (Belimov*et al*, 1995). El-Ghadban*et al*(2006) found that fennel responded to biofertilizer by increasing growth and oil yield and changing the chemical composition. Beyranvand et al (2013) reviled that application nitrogen and phosphate biofertilizers increased yield and yield components of maize under Boroujerd environmental condition. They suggested that effect of nitrogen and phosphate biofertilizers were evaluated positively, there were an increase in plant height, ear weight, number of grain per cob, grain yield and biomass yield. Also Azimi et al (2013b) found that that application nitrogen and phosphate biofertilizers increased yield and yield components of barley under Boroujerd environmental condition. They suggested that Grain yield and biomass yield increasing was reported with the biofertilizer application which account important benefit, causing decreasing in the inputs of production because of economizing much money to chemical fertilizers and increasing in yield and biological yield. Increasing yield was attributed to the plant growth promoting substances by root colonizing bacteria more than the biological nitrogen fixation, (Lin et al, 1983) stated that yield increased due to promoting root growth which in turn enhancing nutrients and water uptake from the soil. Azimi et al (2013a) found that application of Azot barvar2s biofertilizer with Phosphate barvar2 treatment has the highest seed yield (7.6 ton/ha) and non-

application of biofertilizers treatment has the Pishtaz cultivar has the lowest seed yield (6.3 ton/ha). They told that for gave the highest seed yield we should apply both nitrogen and phosphate biofertilizers. Common wheat (*triticumaestivum* L.) is the national staple food in forty -three countries(Mijanur Rahman 2007). According to the statistics of the food and agriculture organization (FAO), during 2008-2009 growing season 682 million tons of wheat were produced and it is estimated that up to 690 million tons will be produced in 2012- 2013 growing season. The experts contend that the amount of the annual wheat production must be 2% higher than the annual demand. The world does not have enough potential for increasing the soil level cultivated with wheat; therefore in order to increase the wheat production, we have to increase the productivity of the fields which have been cultivated with wheat. Grain yield of small grain cereals is determined by two main components, grain number per unit area (grains perm2) and mean grain weight. Environmental conditions around 20 days pre- and 10 days post-anthesis are considered critical for grain yield determination (Savin and Slafer, 1991). During pre-anthesis, the potential grain number per unit area (Fischer, 1985) and potential grain weight (Calderini et al., 2001) are defined. The final grain number per unit area is set immediately after anthesis, while grain filling occurs during the remaining post-anthesis period (Ugarte et al., 2007).Therefore the aim of this study is evaluation of effects of Nand P Bio fertilizers on yield and yield components of wheat.

MATERIAL AND METHODS

This experiment was laid out to evaluate the effects of nitrogen and phosphate bio fertilizers on yield components of wheat at 2014. The experiment was laid out in a factorial design based on randomized block design with three replications. Treatments were Nitrogen bio-fertilizers in three levels (Azot barvar2, Nitrokara and Nitroxin) and phosphor biofertilizer in three levels (Bio-phosphor, Phosphate Barvar 2 and Biozar) with control.There were 5 rows in each from 48 plot; rows were 5 m long with 0.25 m row spacing. At maturity, two outer rows for each plot, 50 cm from each end of the plots, were left as borders and the middle 4 m2 of the three central rowswere harvested. Then yield components were calculated as standard methods with using 8plant. To determine grain yield, biomass yield and harvest index, we removed and cleaned all the seeds produced within two central rows in the field. Then grain yield and biomass yield recorded on a dry weight basis. Yield was defined in

terms of grams per square meter andquintals per hectare. Replicated samples of clean seed (broken grain and foreign materialremoved) were sampled randomly and 1000-grain were counted and weighed. Theharvest index was accounted with follow:

HI = (Economical yield / Biological yield)*100

Statistical analysis

The statistical analyses to determine the individual and interactive effects of treatments wereconducted using JMP 5.0.1.2 (SAS Institute Inc., 2002). Statistical significance was declared at $P \leq 0.05$ and $P \leq 0.01$. Treatment effectsfrom the two runs of experiments followed a similar trend, and thus the data from the twoindependent runs were combined in the analysis.

RESULTS AND DISCUSSION

Analysis of variance of results showed that, the effect of N and P bio-fertilizers and interaction between them on the number of spike per square were significant (table 1). The comparison of the mean values for N bio-fertilizers on number of spike per square showed that Azot barvar2 had the highest (432) and the control treatment had the lowest number of spike per square (525) anddifference between them was significant. For P bio-fertilizers comparison of the mean values of the number of spike per square showed thatbiozarhad the highest (399) and control treatment had the lowest (322) of it. The effect of N and P bio-fertilizers and interaction between them on number of spikelet per spike were significant (table 1). The comparison of the mean values of the number of spikelet per spike for interaction effect of N and P bio-fertilizers showed that application of Nitroxin with other P biofertilizers has the highest (16) and control treatment had the lowest number of spikelet per spike (11) and difference between them were significant. However, the results of analysis of variance showed that, the effect of all treatments on the number of grains per spike were significant (table 1). The comparison of the mean values for interaction of N and P bio-fertilizers on number of grain per spike for wheat showed that combined application of bioposphore and Azot barvar2biofertilizers had the highest (47) and the control combined treatment had the lowest number of grains per spike (31) and difference between them was significant. The results showed that, the effect of N and P bio-fertilizers and interaction between them on 1000 grain weight were significant at 1% (table 1). The interaction effects of comparison means values for 1000 grain weight showed that combined application of Biozar with Nitroxin

and Azot barvar2 had a highest (42 g) and the control treatment in all N biofertilizer levels had the lowest 1000 grain weight (35 g) and difference between them were significant . Moreover, the effect of N and P bio-fertilizers and interaction between them on grain yield were significant at 1% (table 1). The interaction effects of comparison means values for grain yield showed that combined application of Phosphate Barvar 2 with Azot barvar2 had a highest (693 g) per square and the control treatment in all N biofertilizer levels had the lowest grain yield (311 g) per square and differences between them were significant (fig1). The effect of N and P bio-fertilizersand interaction between them were significant on biomass yield(table 1). The interaction effects of comparison means values for biomass yield showed that combined application of Biozar with Azot barvar2 had a highest (1556 g) per square and the control treatment in all N and P biofertilizer levels had the lowest grain yield (793 g) per square (fig2). Results of analysis of variance showed that the effect of N and P bio-fertilizers and interaction between N and P biofertilizerson HI were significant at 1% (table 1). The comparison of the mean values of HI for combined application of N and P bio-fertilizer showed that using of Nitroxin with Biozarhad the highest (49%) and single application ofBiozarbiofertilizer had the lowest HI (36%)(fig3).

Table 1: Analysis of variance (mean squares) for yield and yield components of wheat under application of N and P bio-fertilizer

S.O.V	df	Number of spike per square	Number of spikelet per spike	Number of grain per spike	1000 grain weight	Grain yield	Biomass yield	HI
R	2	1611	6.23	12.16	30.64	8102	218012	11.32
N Biofertilizer	3	13824**	11.22**	445.5**	49.65**	20232**	139367**	180.3**
P Biofertilizer	3	8204*	4.89**	210.33**	83.87**	94988**	201241**	36*
N*P	9	9002**	3.11*	53.01**	19.22**	25214**	164956**	46.28**
Error	30	1397	0.84	10.4	5.78	4456	14942	26.32
CV	-	11.36	12.19	5	6.3	11	7.45	8.12

ns: Non-significant, * and **:Significant at 5 and 1% probability levels, respectively.

In the present study, significant differences were observed among N and P biofertilizers regarding the average number of spikelet per spike, number of spikelet per square, number of grain per spike, 1000 grain weight, biomass and grain yield and HI. For N

biofertilizers application of Azot barvar2 increased average number of spikelet per spike and biomass yield in simple mean comparison. Application of Nitroxin with other P biofertilizers has the highest number of spikelet per spike and difference between that and control were significant. This means that we can apply these N and P biofertilizer with together for achieved to maximum of some yield components for increase of grain yield as well. The positive effect of biofertilizer on yield and yield components of many crops were reviled by many authors (Beyranvand et al, 2013 and Azimi et al, 2013 a,b). This may resulted from its ability to increase the availability of phosphorus and other nutrients especially under the specialty of the calcareous nature of the soil which cause decreasing on the nutrients availability, results agree with (Kucey*et al*, 1989,Tiwari*et al*, 1989). High grain yield in common wheat achieved in combined application of Phosphate Barvar 2 with Azot barvar2. This combined application of N and P biofertilzer increase yield components such as number of spikelet per spike, number of spikelet per square, number of grain per spike, 1000 grain weight and follow that grain yield increased as well. Application of different biofertilizers increase the yield of many crops . For example, Nitroxinbiofertilizerconsists the most effective species of nitrogen stabilizing bacteria for increase efficiency of crop production (Tahmasebi*et al*, 2011). Beyranvand et al (2013) reviled that application nitrogen and phosphate biofertilizers increased yield and yield components of maize under Boroujerd environmental condition. They suggested that effect of nitrogen and phosphate biofertilizers were evaluated positively, there were an increase in plant height, ear weight, number of grain per ear, grain yield and biomass yield. Sharifi and Haghnia (2006) showed that the using of Nitroxinbiofertilizer increased grain yield of wheat .Azimi et al (2013b) found that that application nitrogen and phosphate biofertilizers increased yield and yield components of barley under Boroujerd environmental condition.In present study biomass increased with single application of N and P biofertilizars. Many field studies showed a significant contribution of biofertilizers for the yield and biomass increase of the field crops, which vary in range from 8–30% of control value depending on crop and soil fertility. Biomass yield was increased under application ofbiofertilizers, which positively influenced the plant photosynthesis and dry matter accumulation more actively that agree with

(Shevananda, 2008). Fallahi*et al*(2008) founded that Nitroxinbiofertilizer had significant effects on main yield components, seed yield, essential oil in Chamomile.They concluded that this biofertilizer can beconsidered as a replacement for chemical fertilizers inChamomile medicinal plant production.A significant differences were observed among N and K biofertilizers regarding the average yield and yield components, but in many treats both application of these fertilizers had a better effect on above treats.In the present study 1000 grain weight increase may under the effect of combined application of N and P biofertilizers which induced the uptake ability of the roots to nutrients and positive increase in the yield parameters because of improving the root system as a source-sink relationship to the reproductive part (shoot), that agree with (Mohammed et al ., 2001). According to the data of figure 6, the effect of combined application of nitrogen and phosphate biofertilizers were evaluated positively, there were an increase grain yield as result of yield components. Some researchers determined that enhanced phosphorus releaseincreases evaluations for the trait of grain yield, biomass and 100-seed weight (Khaliq and Sanderz, 2000; Rovira and Ridge, 1979).Azimi et al (2014) suggested that photosynthetic material exchange activity is stimulated through symbiosis with microorganisms in plants with using of biofertilizers that increases the efficiency of photosynthetic phosphorus. They also told that may be photosynthetic capacity of plants treated with phosphors-solving microorganisms increases due to increased supply of phosphors nutrition. In all treatments of P biofertilizers application of Azot barvar2 increased grain yield rather than other P biofertilizers ad we conclude that Azot barvar2 had a synergistic effect with all other P biofertilizers, but in non application of P biofertilizersNitroxin N biofertilizer had a highest grain yield an non application of these biofartilizers has the lowest of grain yield an more confirm synergistic effect of these N and P biofartilizers on yield and yield components of common wheat. Combined application of N and P iofertilizersincreased number of grain per spike, 1000 grain weight, biomass, grain yield and HI in simple mean comparison. Therefore this is a synergic effect of these fertilizers on yield components of common wheat too. This means that we can apply N and P biofertilizer with together for achieved to maximum yield and it components as well.

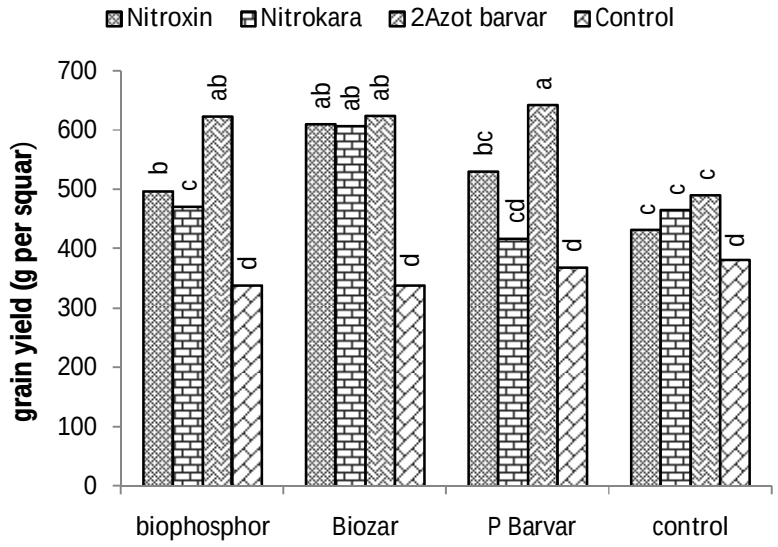

Figure 1.Interaction effect of N and P bio-fertilizers on grain yield of wheat. Means by the uncommon letter in each column are significantly different (p<0.05).

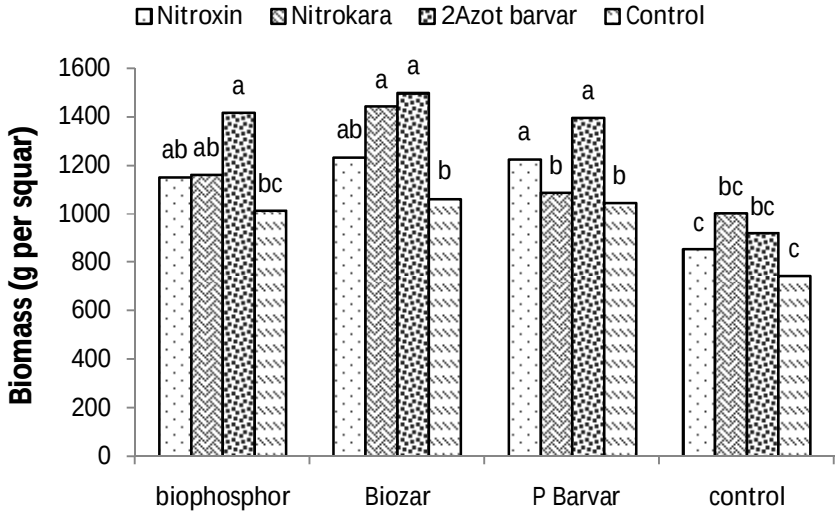

Figure 2.Interaction effect of N and P bio-fertilizers on biomass yield of wheat. Means by the uncommon letter in each column are significantly different (p<0.05).

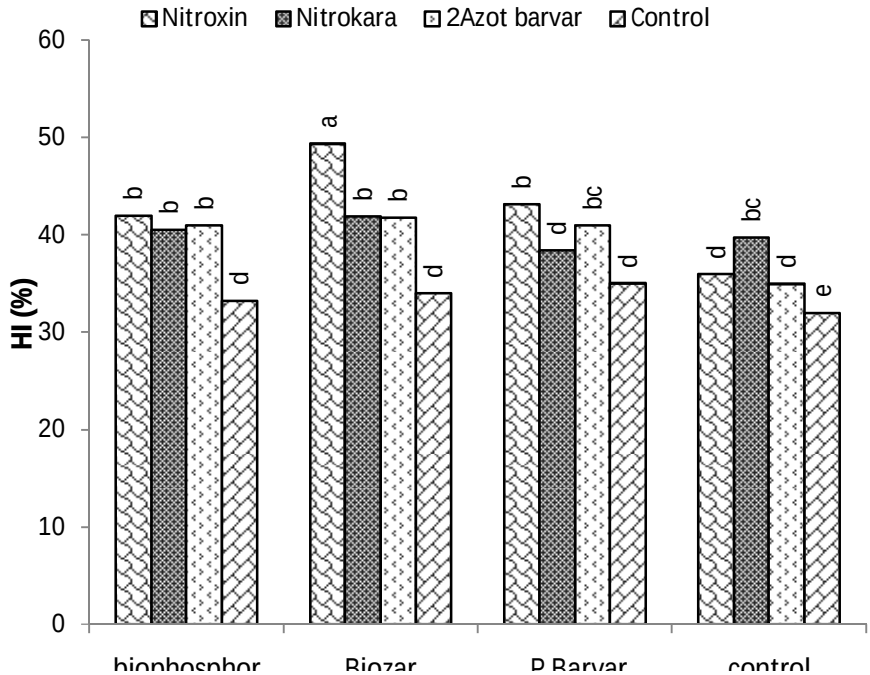

Figure 3: Interaction effect of N and P bio-fertilizers on harvest index (HI) in wheat. Means by the uncommon letter in each column are significantly different (p<0.05).

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