# The Effect of Bio-fertilizer (Phosphate Barvar2) on the yield and yield components of bread wheat and durum in Ahvaz region

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**Abstract**

In order to evaluate the effectiveness of phosphorus biological fertilizers (Barvar2) and triple super phosphate fertilizer amounts on the yield and yield components of bread wheat and durum, a split-split plot experiment within randomized completely block design with four replications in December 2009 in research farm of Agriculture and Natural Resources University of Ramin in Khuzestan was carried out. The main plots were chemical fertilizer triple super phosphate (zero, 50% and 100% of phosphate fertilizers), subplots were bio-fertilizer barvar2 (control, by basal application and top dressing) and sub-subplots were wheat cultivars (Chamran and Behrang). Results showed that 50% of phosphorus with the barvar2 base led to a No. 349.54 for spike number, grain yield 3309.5 kg and 10932.1 kg of biomass to ensure that this amount 100% of the recommended intake of phosphorus fertilizers match. Grain weight and harvest index attributes that have not been affected by the biological fertilizer. The results of this study showed that the use of phosphorus biological fertilizer (barvar2) can be used as a substitute for a portion of the phosphorus fertilizer, without a decrease in yield occurs.

**Keywords:** Cultivar, Yield, phosphorus, Harvest index

## Introduction

Bread wheat has the largest distribution in the world and the most famous bread wheat used for bread, and bread due to the presence of gluten in grains of high value and quality. Durum wheat after bread wheat is very important. One of the main products in the food basket of pasta is that its importance is obvious. Many measures to increase wheat production per unit area, including the use of improved varieties, increased varieties resistant to pests and diseases, improved agronomic practices and the use of chemical fertilizers have been made (Sharma et al, 2007). But one of the important elements to achieve optimal performance per unit area, is the element phosphorus that plants it in the form of ions $HPO_4^{-2}$ and $H_2PO_4^{-2}$ absorb. (Iman and Azouni, 2008) Increased availability of phosphorus in plants by phosphate fertilizers, which are used as a base. But after taking large amounts of fertilizer, approximately 95% to 99% in the soil is non-soluble. Therefore, their continued use is necessary (Rajankar et al, 2007). Several factors such as pH, percentage of lime, calcium solution, EC, the amount of clay, pressed or compacted soils, high soil temperature and soil organic matter can affect the stabilization of soil phosphorus (Behbahani, 2010). But continuous use of excessive phosphate fertilizer regardless of the staggering costs of fertilizers out of the country, an important negative impact on soil fertility may have. So the revision of the management towards the use of phosphate fertilizers and new methods such as biological methods necessary it looks like. Fertilizer Biological certain number of micro-organisms comprises the ability to be a macro elements such as nitrogen and phosphorus in the form inaccessible during the process to form become available (Alamri and Mostafa, 2009). Cheng and Yang (2009), the main advantages of bio-fertilizers as compared to chemical substances considered in the food chain, the production of toxic substances and not biological, spontaneous reproducibility have improved physical and chemical properties of soil and economically affordable Oh and environmental damage are acceptable. The most important micro-organisms can be bacteria Pseudomonas and Bacillus genus phosphate solubilizing noted that since 1950 has been used as organic fertilizer (Tilak et al, 2007). These micro-organisms with incomplete oxidation of sugars, organic acids produce such as acids formic, acetic, lactic and fumaric that this acid to reduce the pH are the breaks in the form of phosphate bonds (Lihan and Sakin, 2010; Nader et al, 2008). Also, Mehrvarz and Chaichi (2008) stated that biological fertilizers containing phosphate solubilizing bacteria have the ability to supply the phosphorus needed by plants and stimulate the growth of the plant. Hameeda et al (2008) reported that inoculated seeds of corn with organic fertilizer containing Bacillus and P. speed germination in the plant. Mansk et al (2000) also wheat seeds were inoculated with different strains inoculated and their results suggest that root length density increased in all varieties this leads to improved efficiency of nitrogen and phosphorus and the find a significant increase in grain yield.

According to the biotechnology producer company report, biofetilizer barvar2 the use of native strains of bacteria solution containing phosphate doing ten species Pseudomonas putida and Bacillus produced, respectively, by using acid secretion mechanism organic and acid phosphatase insoluble phosphorus compounds break down and be absorbed as a result of the plant. Effects of biological fertilizers containing phosphate solubilizing bacteria in wheat would reduce reliance on chemical inputs in the plant with the use of micro-organisms in the supply of dissolved phosphorus in the soil, reduce the consumption of fertilizer and agricultural development. Since the effect of these bacteria in the common agricultural and ecological systems has been little study of this study was to evaluate the effect of these bacteria on yield and yield components in wheat cultivars Chamran and Behrangi (in the year past known line D79) was performed.

## Materials and Methods

The field experiment in a randomized complete block design with four replications 2009 Research Station, Agriculture and Natural Resources University of Ramin in 35 km North East of Ahwaz city, Molasani in the eastern margin of the Karun River with a width of 31 degrees and 36 minutes north, longitude 48 ° and 53 ° east and a height of 22 meters above sea level plot was split. Physical and chemical analysis of the soil in Table 1 below. Phosphate fertilizer treatments consisted of three levels (P0: Control or without the use of fertilizers, P.5: 50% of phosphorus, P1 Consumption of 100% of the recommended amount of phosphorus) in the main plots and different stages of biological fertilizer barvar2 (B0: control, B1: by basal application (Seed treatment) and B2: top dressing application) as sub-plots and wheat cultivars, including chamran (bread) and the Behrang. (Durum) in sub-sub plots were considered.

**Table 1. The results of analysis of soil samples used in experiment**

| Soil texture | Na (%) | P (mg/l) | K (mg/l) | pH | EC (ds/m) | Organic matter (%) |
|---|---|---|---|---|---|---|
| clay silt | 0.07 | 4.6 | 87 | 7.5 | 2.41 | 0.3 |

Phosphorus fertilizer triple super phosphate was used in this experiment. Preparing the arable land with plows and discs was carried out. 50% of nitrogen from urea source when preparing the soil was mixed. Experimental plots depending on the type of fertilizer phosphorus on the basis of 200 kg of triple super phosphate and biological fertilizers (barvar2) as a seed treatment at a rate of 100 grams per hectare received and seeds of wheat (Chamran) and durum wheat (Behrang), respectively, with a density of 400 and 450 plants/$m^2$ were killed on 14 December. Top dressing 2 to 100 gr/ha with irrigation water applied. On 7 May was the final harvest and then put in bags for operations that were taken. Number of spike, 1000 seed weight, grain yield, biological yield and harvest index were measured. All the data were analyzed with analysis of variance (ANOVA) procedures using the SAS 9.1. Least significant difference test ‘‘LSD’’ at 5% level of probability was used to compare means of the treatments.

## Results and discussion

### Spike number

According to the analysis of variance (Table 2), effect of phosphorus fertilizer, barvar2 fertilize and cultivar and interaction effect between phosphorus and barvar2 on the total number of spikes were significant. Results Mean comparison showed the highest spike in treatment of 100% phosphorus fertilizer along with barvar2 by base was obtained. Also, the number of spike in 50% of phosphorus with the barvar2 for basic consumption was equal with treatment of 100% phosphorus without using barvar2 (Figuer 1). Karthikeyan et al (2008), increasing the number of spike per square meter was confirmed using biological fertilizers, stating that wheat seed inoculation with phosphate solubilizing bacteria associated with increased solubility of phosphorus chemical fertilizer, which promotes the development of root system and increase the number of tiller and ultimately increase the number of spike per square meter.

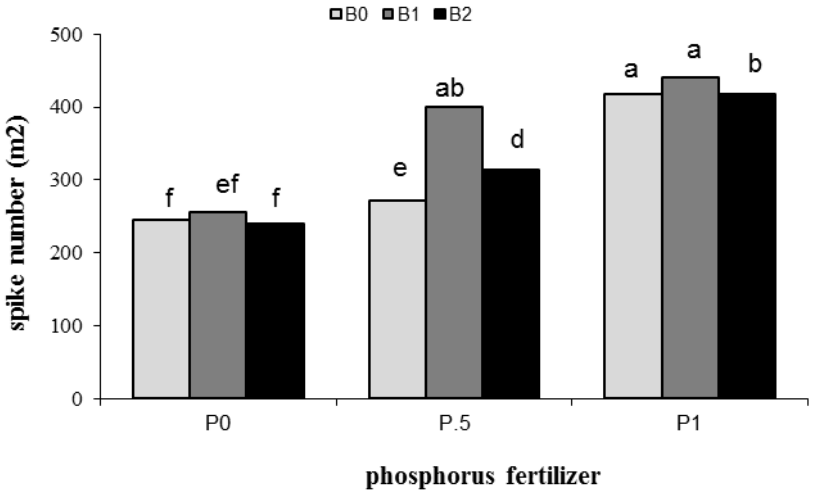


**Figure 1: The effect of phosphorus fertilizer and bio-fertilizer on spike number of wheat**

## 1000 seed weight

A qualitative grain weight, which depends heavily on sources of plant photosynthesis. Based on analysis of variance (Table 2), the effect of phosphorus fertilizer, barvar2, cultivar and interaction effect phosphorus and cultivar on grain weight were significant. While the effect of phosphorus fertilizer and barvar2, and the interaction of three factors: phosphorus and barvar2 and cultivar was not significant. Another important point in investigating the seed weight was observed that the effect of the combination bio-fertilizer of barvar2 and P on this character not significant. The reason it can be said that good nutrition during the reproductive phase of growth resulted in a good number of grains per spike achieved. This has led to more grain handling to be able to complete all the levels of tank capacity (seeds) are not the result of reduced grain weight (Ken-Jer, 2007). Figure 2 observed that both cultivars in seed weight phosphorus levels were quite different, so that behrang cultivar (V2), 1000 Seed weight than chamran (V1), which is the advantage of the characteristics of genetic away bread figures are always higher grain weight.

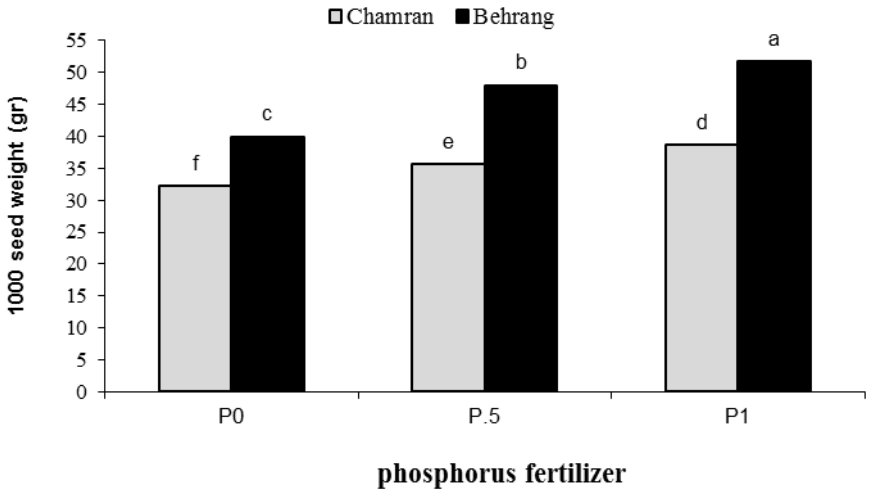


**Figure 2: The effect of phosphorus fertilizer on 1000 seed weight of wheat cultivar**

## Grain yield

Based on the results contained in Table 2, effect of phosphorus fertilizer, barvar2 fertilizer, cultivar and interaction between phosphorus and barvar2, the effect of phosphorus fertilizer and cultivar on grain yield were significant. The highest grain yield was at 100% phosphorus fertilizer with barvar2 by base. Figure 3 showed that without phosphorus fertilizer use (P0), the lowest seed yield (1692.5 Kg) has been and added to the barvar2 by base and top-dressing could not make up for this loss. It can be said that phosphate solubilizing bacteria alone does not enhance yield and to apply the effect should be taken with some chemical fertilizers. Also, Figure 4 shows that different levels of phosphorus in the yield of cultivar two are different and always behrang cultivar was higher than the yield.

The difference in reaction cultivars in the use of fertilizers, indicate that the interaction of fertilizer-cultivars defined in the genome. But in control, the absence of phosphorus in a ratio of two cultivars limits (Olivera et al, 2002). Kizikaya (2008) reported that the increasing mobility of phosphorus, affected plant growth, increased leaf area index and plant Photosynthesis and ultimately increasing the yield.

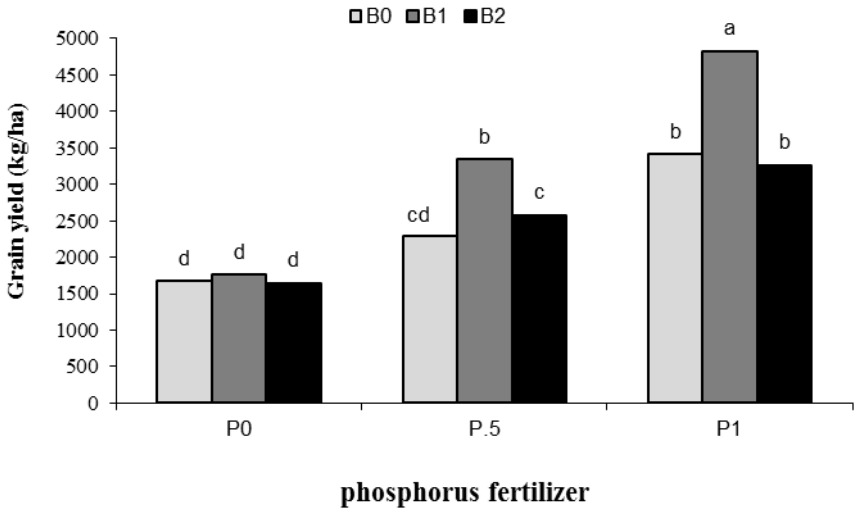


**Figure 3: The effect of phosphorus fertilizer and bio-fertilizer on grain yield of wheat**

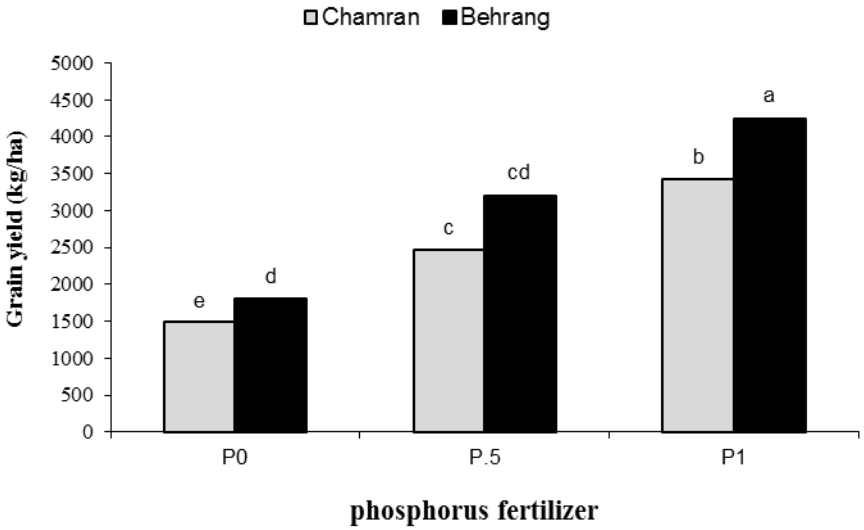


**Figure 4: The effect of phosphorus fertilizer on grain yield of wheat cultivar**

## Biological yield

Biomass represents shoot dry matter at harvest time is accumulated. Based on the analysis of variance table 2, the effect of phosphorus, barvar2, cultivar and interaction between phosphorus and barvar2 on biological yield was significant. Mean comprise showed that the least amount of biological yield was in the control treatment without Phosphorus fertilizer consumption.

Base and top-dressing consumption of barvar2 fertilizer could not make up for the absence of phosphorus. 50% treated with phosphorus fertilizer along with barvar2 fertilizer by basic was biological yield higher than 100% phosphorus fertilizer without barvar2 (figure 5). The reason it can be said that with the dissolution of insoluble phosphates and phosphate solubilizing microorganisms increase the amount of available phosphorus increased nitrogen fixation, resulting in increased plant growth, especially the shoot. Because for nitrogen fixation, a lot of energy is required with sufficient phosphorus and ATP Abundant supply (Hameeda et al, 2008). However, the highest biomass obtained in 100% P 2 as well as a barvar2 by base was observed, but it can be stated that 50% of phosphorus with the barvar2, the biological yield has been.

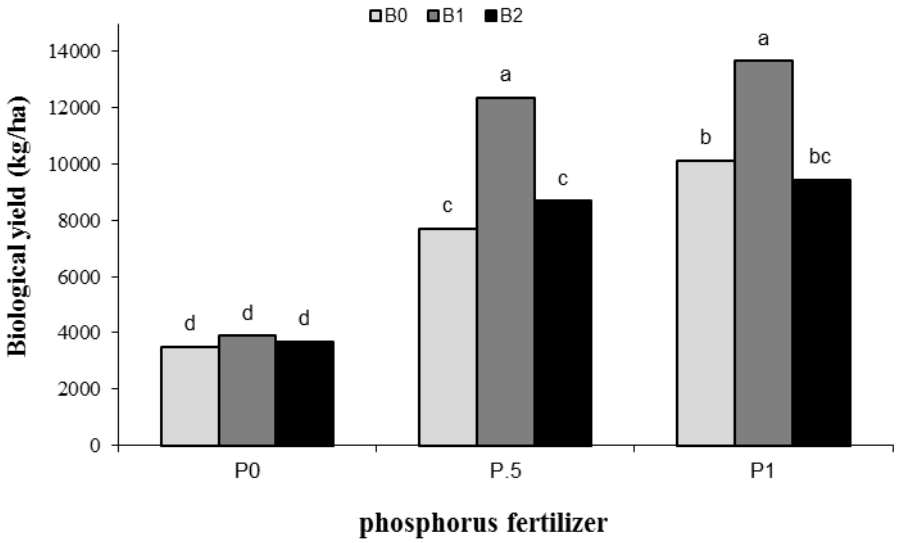


**Figure 5: The effect of phosphorus fertilizer and bio-fertilizer on biological yield of wheat**

## Harvest index

Harvest index indicates the relative distribution of assimilates between economic reservoir and other tanks in the plant. Based on the results in Table 2, effect of phosphorus fertilizer and cultivar and interaction between phosphorus and Barvar2 on the harvest index was significant. In Figure 6, it can be seen that at all levels of fertilizer phosphorus use Barvar2 base (B1) had the greatest effect on harvest index. However, the use of barvar2 by top-dressing (B2) decreased harvest index. Probably bacteria in the fertilizer, in the top-dressing use has been parasites form and phosphorus in their consumption. But Nabila et al (2007), bio-fertilizer effect on harvest index has declined and it is considered indicative of farm management, which can be affected by treatments.

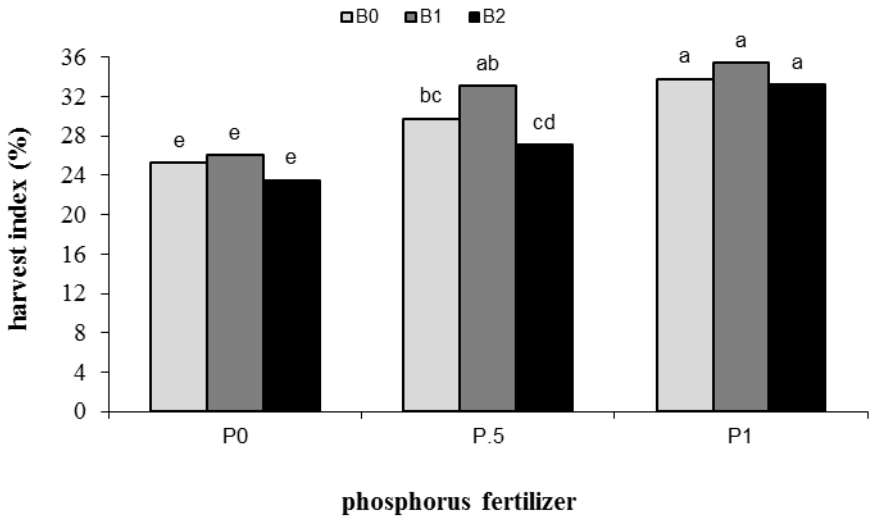


**Figure 6: The effect of phosphorus fertilizer and bio-fertilizer on harvest index of wheat**

## Conclusion

Bio-fertilizers alone and without use of chemical fertilizers can affect the yield of wheat cultivars and to exert their effect should be used along with chemical fertilizers. The results of this study, the use of 50%phosphorus fertilizer with barvar2 fertilizer can replace 100% phosphorus fertilizer, done without decreasing yield. Also, behrang cultivar was in response to fertilize barvar2 similar chamran, to the seed weight is genetically determined and this led to the cultivar of greater yield.

**Table 2: Analysis of variance on the effect of Bio-fertilizer on the yield and yield components of bread wheat and durum.**

| S.O.V | df | Number of spike | 1000 seed weight | grain yield | biological yield | harvest index |
|---|---|---|---|---|---|---|
| block | 3 | 865.7 $^{ns}$ | 16.2 $^{ns}$ | 98272 $^{ns}$ | 696845 $^{ns}$ | 5.3 $^{ns}$ |
| phosphorus (P) | 2 | 193416.8$^{**}$ | 366.3 $^{**}$ | 27153867$^{**}$ | 11095879$^{**}$ | 501.8 $^{**}$ |
| block ×P | 6 | 670.4 $^{ns}$ | 3.7 $^{ns}$ | 311560 $^{ns}$ | 2878422 $^{ns}$ | 12.8 $^{ns}$ |
| bio-fertilizer (B) | 2 | 90508.1$^{**}$ | 56.9$^{**}$ | 5510667.7$^{**}$ | 62378346 $^{**}$ | 0.44 $^{ns}$ |
| P ×B | 4 | 2910.1* | 9.5 $^{ns}$ | 1377358$^{**}$ | 17044134$^{**}$ | 42.7$^{**}$ |
| Error | 18 | 489.3 ns | 4.6 $^{ns}$ | 157108 $^{ns}$ | 1723364 $^{ns}$ | 3.7 $^{ns}$ |
| Cultivar (C) | 1 | 6102.1$^{**}$ | 2210.8$^{**}$ | 4859450$^{**}$ | 19885652$^{*}$ | 91.8$^{**}$ |
| C ×P | 2 | 128.9 $^{ns}$ | 13.1$^{**}$ | 570222 $^{**}$ | 3254775 $^{ns}$ | 8 $^{ns}$ |
| B ×C | 2 | 128.9 $^{ns}$ | 1.8 $^{ns}$ | 570222 $^{ns}$ | 1789007 $^{ns}$ | 17.4 $^{ns}$ |
| P × B× C | 4 | 46.6 $^{ns}$ | 22.4 $^{ns}$ | 126578 $^{ns}$ | 1818479 $^{ns}$ | 4.1 $^{ns}$ |
| Error | 27 | 493.3 | 4.2 | 352949 | 2812955 | 9.7 |
| CV (%) | - | 6.7 | 4.9 | 21.4 | 18.4 | 10.5 |

*, ** and ns: significantly difference at the 0.05 and 0.01 probability levels, respectively, and indicating no significant difference

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