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Research article

INFLUENCE OF BACTERIUM AZOSPIRILLUM ON BIOLOGICAL YIELD, GRAIN YIELD AND THOUSAND GRAIN WEIGHT IN SOY BEAN

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ABSTRACT: Legumes plant plays an essential role in sustainability of agricultural systems. Soybean (*Glycine max*) is one of the most important sources of oil and protein and is commonly used in both human and animal diets. One of the fertilizers that are used a lot in various crop plants is phosphorous, which is applied as phosphorous fertilizers to the soil. The experiment was conducted at the miandoroud sari (in Iran). The field experiment was laid out in randomized complete block design with factorial design with three replications. Factor A included bacterium azospirillum (A1: insemination; A2: No insemination), factor B included Phosphate fertil 2 (B1: insemination, B2: No insemination) and factor c included phosphorus fertilizer (C1: No insemination, C2: 50kg). Analysis of variance shows that Azospirillium brasilense has a significant effect on biological yield, grain yield at 1% level.

Key words: Glycine max, Phosphate fertil 2, phosphorus fertilizer

INTRODUCTION

Legumes plant plays an essential role in sustainability of agricultural systems. Their role is increasing during conversion of traditional agriculture to organic one. Legumes, in particular soybeans (*Glycine max*. L.) plants are considered as major sources of vegetable proteins and oils. Besides their economic importance they have also an ecological significance, diminishing atrophic pressure on the environment. Likewise, it is established that the main products of biological nitrogen fixation of tropical legumes are ureides. These compounds are transported outside of nodules through xylem to above ground plant parts. According to literature data N2 fixation is very sensitive process to environmental stress factors [21, 23]. Soybean (*Glycine max*) is one of the most important sources of oil and protein and is commonly used in both human and animal diets [1]. Moreover, soybean is increasingly becoming important as a source of oil for biodiesel production. This trend is likely to continue, at an even faster rate, considering the volatility in crude oil prices and/or the environmental concerns related to use of crude oil [11]. One of the fertilizers that are used a lot in various crop plants is phosphorous, which is applied as phosphorous fertilizers to the soil. Unfortunately, in the past, this fertilizer was used in crop fields without conducting soil tests; and there were no correct and appropriate recommendations concerning the use of phosphorous fertilizers. This led to a rate of phosphorous application far greater than what was required, so that in many regions the available phosphorous in the soil is many times more than the critical level [13]. Tsvetkova and Georgiev [24] are of the opinion that phosphorous is an essential element for the growth and (high) yield of soybean. Randall et al. [19] reported that phosphorous application caused an increase in manganese absorption (and hence led to a reduction in manganese deficiency). Raboy and Dickinson [17] think that application of different rates of phosphorous and zinc raises their contents in the seeds and leaves of soybean and reduces seed protein content. Mabapa et al. [12] came to the conclusion that phosphorous did not affect the harvest index, while Ogola et al [15] and Malik et al [14] reported that phosphorous had a positive effect on increasing the harvest index of soybean. Garcia and Hanway [9] found that foliar application of the elements nitrogen, phosphorous, potassium, and sulfur at seed filling stage had a greater influence on the growth and yield of soybean than the application of these elements to the soil. The higher P concentration in nodules demonstrates the higher demand of legumes for P nutrition.

Some studies have established that improving plant nutrition with P contributed to increase plant tolerance to drought. It was observed that phosphorus fertilization stimulates root growth [22], photosynthesis [8] and increase hydraulic conductibility of roots [18]. Also, studies elsewhere show that low native soil phosphorus availability coupled with poor utilization efficiency of added P is a major constraint limiting the productivity of soybean. However, the use of fertilizer P is limited by its high cost, while organic inputs generally do not provide sufficient P for optimum crop growth due to their low P concentration [2]. For almost 100 years, Rhizobium inoculants have been produced around the world, primarily by small companies. Some legumes, like the soybean (*Glycine max* (Merr.)L.) in Brazil, are not fertilized with nitrogen, but are only inoculated (Döbereiner, lecture in: VI Azospirillum conference). For rhizobial inoculants, a molecular dialogue between the host plant and the bacterium results in root nodulation and nitrogen fixation, involving plant flavonoids and bacterial nodulation (Nod) factors, identified as lipochitooligo saccharides (LCOs) [7, 10, 16, 20]; however, the roles of other molecules, such as those related to type-III secretion systems and exopoly saccharides (EPSs) [4, 6, 16] have also been emphasized. Phosphorus is an important plant nutrient involved in several energy transformation and biochemical reactions including biological nitrogen fixation. Phosphatic fertilizers have low efficiency of utilization due to chemical fixation in soil [14] and poor solubility of native soil phosphorus, sometimes there is a buildup of insoluble phosphorus as a result of chemical phosphorus application [5]. Inoculation with nonsymbiontic, associative rhizosphere bacteria, like Azotobacter, was used on a large scale in Russia in the 1930s and 1940s. The practice had inconclusive results and was later abandoned [18]. Interest in Azotobacter as an inoculant for agriculture has only recently been revived. An attempt to use Bacillus megaterium for phosphate solubilization in the 1930s on large scale in Eastern Europe apparently failed [13].

MATERIAL AND METHODS

The experiment was conducted at the miandoroud sari (in Iran) which is situated between 21° North latitude and 63° East longitude and at an altitude of 132m above Mean Sea Level. The soil of the experimental site belonging is clay loam. Composite soil sampling was made in the experimental area before the imposition of treatments and was analyzed for physical and chemical characteristics. The field experiment was laid out in randomized complete block design with factorial design with three replications. Factor A included bacterium azospirillum (A1: insemination; A2: No insemination), factor B included Phosphate fertil 2 (B1: insemination, B2: No insemination) and factor c included phosphorus fertilizer (C1: No insemination, C2: 50kg). A week after emergence, seedlings were thinned to maintain two plants per hill. Final thinning was done two weeks after emergence to maintain only one healthy seedling per hill. In this test a soybean cultivar named Sari who had improved cultivars were used. The bacteria clinics, medical plant with bacteria produced organic manure ready to use that set of PGPR PEPR plants of the genus Azotobacter / Azospirillum is. 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.

RESULT AND DISCUSSION

Biological yield

Analysis of variance shows that Azospirillium brasilense has a significant effect on biological yield at 1% level (Table 1) so that comparison shows the highest biological yield 2470.33 Inoculation of azospirillum (a1) and the lowest biological yield was no insemination (1907.83). Barbieri et al, 1993 reported that infection with Azospirillum plant dry weight, the average has increased 12.3 percent compared with the controls. The results of these experiments are consistent with the experiments conducted. Agree with Azospirillum inoculation on root growth and much greater access to water and nutrients and thus increase the shoot dry weight. Phosphate fertilize 2 make a significant impact on the soybean plant is not dry (Table 1). During a field trial in India reported that the effect of PSB on Soybeans was examined and it was shown to lead to a significant increase in the dry weight of the bacteria.

Thousand grain weight

Analysis of variance showed that the Azospirillum has no significant effect on thousand grain weight (Table 1). Response of wheat cultivars to infection Azospirillium brasilense thousand grain weights is often increased [7] Test results are inconsistent with the likely loss of nutrient uptake by the plant is inoculated with Azospirillium baselines. Phosphate fertilizes 2 make a significant impact on soybean thousand grain weights yet. In soybean fields treated with 2 fertile thousand grain weight was increased is inconsistent with the results of the experiments conducted is probably due to unfavorable environmental conditions. Analysis of variance indicated that none of the levels of phosphorus in soybean has any significant effect on thousand grain.

The results of these tests, the test results are in contrast to the lack of increase in thousand grain weight may be influenced by phosphorus because phosphorus is immobile in the soil, resulting in the form of absorbable received plant. Interaction Azospirillium brasilense and phosphate fertilized 2 caused no significant effect on thousand grain weight (Fig-1).

Table 1. Mean squares of biological yield, thousand grain weight and grain yield

S.O.V	df	MS		
		Biological yield	Thousand grain weight	grain yield
R	2	6282 ns	3 ns	56870 ns
A	1	1898437**	26 ns	437940**
B	1	79350 ns	5 ns	28704 ns
C	1	42168 ns	30 ns	10250 ns
A*B	1	174080*	9 ns	311904*
A*C	1	2860 ns	108 ns	4760 ns
B*C	1	729410**	210 ns	95508 ns
A*B*C	1	376000**	126 ns	192246 ns
Error	14	30864	217	47157

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

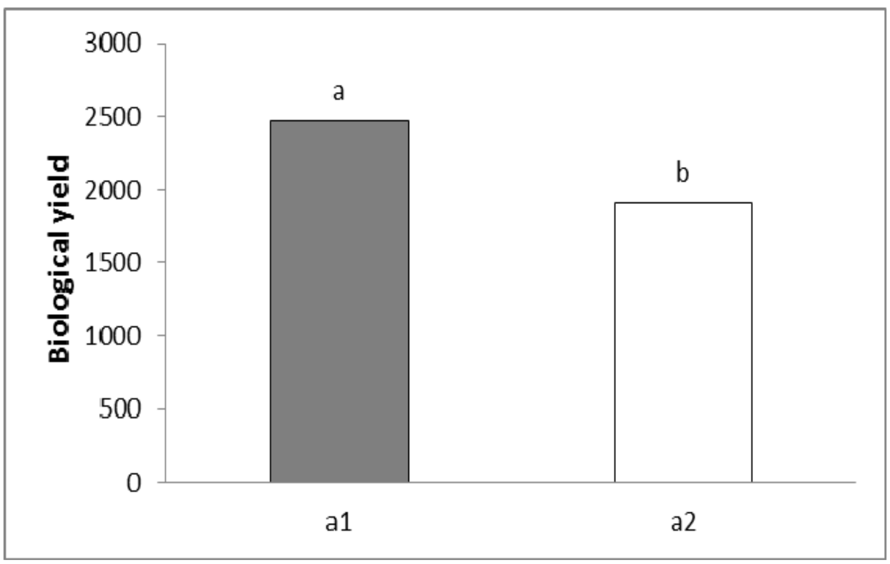

Fig-1: Biological yield

Grain yield

Analysis of variance shows that Azospirillium brasilense has a significant effect on grain yield at 1% level (Table 1) so that comparison shows the highest grain yield 1580.20 Inoculation of azospirillum (a1) and the lowest grain yield was no insemination (1310.08). A team of researchers investigating the role of Azospirillum bacteria found in wheat farming the application of this bacterium significant effect on Grain yield increase has been attributed to non-application [3]. This increase is probably due to the increased uptake food, improving plant water potential, improving plant growth resulting in better nutrition and may the increase in activity is due to photosynthesis. Phosphate fertilized 2 in this experiment is not significant effect on soybean Grain yield. These experiments are examined in contrast to the decline in performance is probably due to decreased nutrient absorption, reduce the growth of the result of feeding The plants may be due to reduced activity of photosynthetic plants. Phosphorus fertilizer in this experiment has a significant effect on soybean Grain yield (Fig-2).

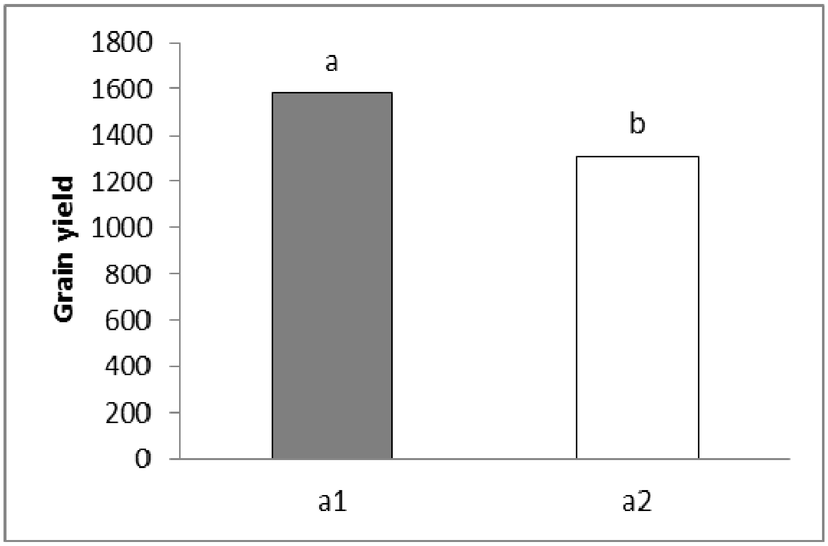

Fig-2: Grain yield

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