

ORIGINAL ARTICLE

Effects of Bio-and Chemical Fertilizers on growth and yield of Faba bean (*Vicia faba* L.)

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ABSTRACT

To study the effect of chemical and biological fertilizers of phosphorus and nitrogen on growth and yield of faba bean an experiment was carry out as split- split-plot with three replications in Bazkiagorab, Lahijan. The main factor was the composition of nitrogen and phosphorous fertilizers on five levels: 1-control (no consumption of mineral fertilizers), 2-35 TSP+50 urea kg/ha, 3-35 TSP+100 urea kg/ha, 4-17.5 TSP+50 Urea kg/ha, 5-17.5 TSP+100 Urea kg/ha, other factors were a-the phosphorus biological fertilizer and b-nitrogen biological fertilizer as inoculated and non-inoculated. The results showed that the grain yield, grain weight, biological yield, harvested index and plant height significantly affected by using chemical and biological fertilizers, but the length and width of pods and length of seeds was not different significantly. The highest grain yield, 3.41 tons/ha, and weight of 100 grain, observed in treatments using inorganic fertilizer (35 TSP+100 Urea kg/ha) + nitrogen bio-fertilizer and without phosphorus bio-fertilizer but the lowest grain yield was obtained in control treatment with 2.45 tons/ha. The highest plant height, 174.63 cm, was obtained in the nitrogen biological fertilizer treatment. Use of chemical fertilizer was significantly increased harvested index than control treatment and the highest HI was obtained in 35 TSP+50 urea kg/ha.

Keywords: faba bean, Nitrogen, Phosphorous, Biological fertilizer, Yield

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INTRODUCTION

Faba bean (*Vicia faba* L.) is one of the major leguminous crops grown in the world. It is important source of protein for humans and animals. Its seed not only provide a cheap source of protein but also a food of high calorific and nutritive value. Excessive use of chemical fertilizers, especially when accompanied by unsuitable management practices reduces the amount of soil organic matter. Hence, physical, chemical and biological properties of soil will be negatively affected and increased soil erosion [1].

Now, on the sustainable agriculture, bio-fertilizers considered as an alternative to chemical fertilizers. Because, bio-fertilizers increasing soil fertility, while reduce the environmental impact of chemical fertilizers [2]. Bio-fertilizers are included to different kinds of free-living microorganisms which have ability to convert nutrients from unavailable to available form and produces plant growth stimulating factors by biological processes [3].

Nitroxin containing to Azotobacter and Azospirillum and Super Nitro Plus containing to nitrogen fixing bacteria, plant growth promoting regulator (PGPR) and soil pathogens controllers [4]. The positive effects of bio-fertilizer such as Nitroxin and Super Nitro Plus on growth and development of crops observed in many studies. Shehta and Khawas [5] observed that the use of bio-fertilizer increased grain yield and quality traits

of sunflower as compared to control. Also, Piraste Anoooshe et al [6] observed that the grain yield of sunflower increased under influence of bio-fertilizer.

Phosphate dissolving bacteria and soil microorganisms can play an important role in improving plant growth and phosphate uptake efficiency by releasing phosphorus from rock or tri-calcium phosphate. Many researchers showed positive effect of phosphorus fertilization on faba bean.

Microorganisms can play an important role in the availability of phosphorus in the soils. More phosphorus is proved to be taken by the plant in the presence of phosphate dissolving microorganisms [7]. Many investigators reported that phosphate dissolving bacteria enhance crop growth, improve seed and straw yields and increase nutrient uptake [8,9]. The aim of this study was to compare the effect of N and P bio fertilizer, with mineral N and P fertilizers on yield and growth of faba bean in Lahijan, Iran.

MATERIALS AND METHODS

The experiment was conducted at the Bazkiagorab, Lahijan Iran with latitude 37° 21' 669" N and longitude 37.2° 50' 01" E and elevation of 25 m above the sea level, during the 2012 growing season. The experiment was conducted as split-split-plot with three replications. The main factor was the composition of nitrogen and phosphorous fertilizers on five levels: 1-control (no consumption of mineral fertilizers), 2-35 TSP+50 Urea kg/ha, 3-35 TSP+100 Urea kg/ha, 4-17.5 TSP+50 Urea kg/ha, 5-17.5 TSP+100 Urea kg/ha, other factors were a-the phosphorus biological fertilizer and b-nitrogen biological fertilizer as inoculated and non-inoculated. Soil samples were collected prior to the experiment. Soil physical and chemical properties are shown in Table 1. Before planting faba bean seeds were washed with water, air dried and mixed with Biological fertilizers. Seeds of faba bean were planted on the two ridge sides with rows separated 35 cm. Nitrogen and Phosphorus levels were added before planting in the form of Urea and TSP respectively. Other cultural practices were kept the same as normally practiced farmers in faba bean fields.

At harvest, plants were taken at random from the central ridge to determined: plant height (cm), Plant dry weight, weight of 100-seed (g), and Seed yield. All the data were subjected to statistical analysis using SAS software (SAS Institute, version 9.2). Where the F-test showed significant differences among means, differences between the treatments were performed by Duncan's Multiple Range Test.

RESULTS AND DISCUSSION

Table 1. Some physical and chemical properties of soil

pH	EC	O.C	CCE	Nt	P	K	Sand	Silt	Clay
xxx	dS/m		%			mg/kg		%	
6.93	0.384	1.01	5.33	0.09	11.71	113.15	20	50	30

Analyses of variances for all treatments presented in table2. The results showed that the grain yield, 100-grain weight, significantly affected by using chemical and biological fertilizers, but dry weight and plant height was affected significantly by bio-fertilizer.

Result show that among treatment, P-bio-fertilizer with 151.5 and N-bio-fertilizer with 156.3 g had the highest plant dry weight. These treatments can increase 6 and 13.5% plant dry weight compared to control, respectively (Fig1). It could be suggested that nitrogen and phosphorous bio-fertilizer in this experiment had a positive impact on plant growth and increased plant dry weight.

Table.2. Analysis of variance of effect of Bio and chemical fertilizer on Yield and growth of faba bean

S.O.V	DF	Plant dry weight	100-grain weight	Grain yield	Plant height
Chemical fertilizer	4	129.73 ^{n.s}	186.91 ^{**}	0.46 ^{**}	31.51 ^{n.s}
P-bio	1	1262.71 ^{**}	407.79 ^{**}	0.004 ^{n.s}	264.56 [*]
Nitroxin	1	5290.14 ^{**}	1719.49 ^{**}	1.28 ^{**}	1907.56 ^{**}
Block	2	31.16 ^{n.s}	1.36 ^{n.s}	0.099 ^{n.s}	154.37 [*]
Chemical*Block	8	66.55 ^{n.s}	4.02 ^{n.s}	0.071 ^{n.s}	27.07 ^{n.s}
P-bio *Block	10	45.61 ^{n.s}	1.93 ^{n.s}	0.069 ^{n.s}	45.54 ^{n.s}
Chemical* P-bio	4	237.15 ^{n.s}	113.89 ^{**}	0.192 [*]	39.76 ^{n.s}
Chemical*Nitroxin	4	59.48 ^{n.s}	2.48 ^{n.s}	0.190 [*]	24.49 ^{n.s}
P-bio *Nitroxin	1	2.47 ^{n.s}	128.48 ^{**}	0.387 ^{**}	20.94 ^{n.s}
Chemical*P*Nitroxin	4	94.29 ^{n.s}	29.71 ^{**}	0.238 ^{**}	24.36 ^{n.s}
Error	20	120.55	4.11	0.0454	46.21

Fig.1. Effect of P and N Biofertilizer on Plant Dry weight

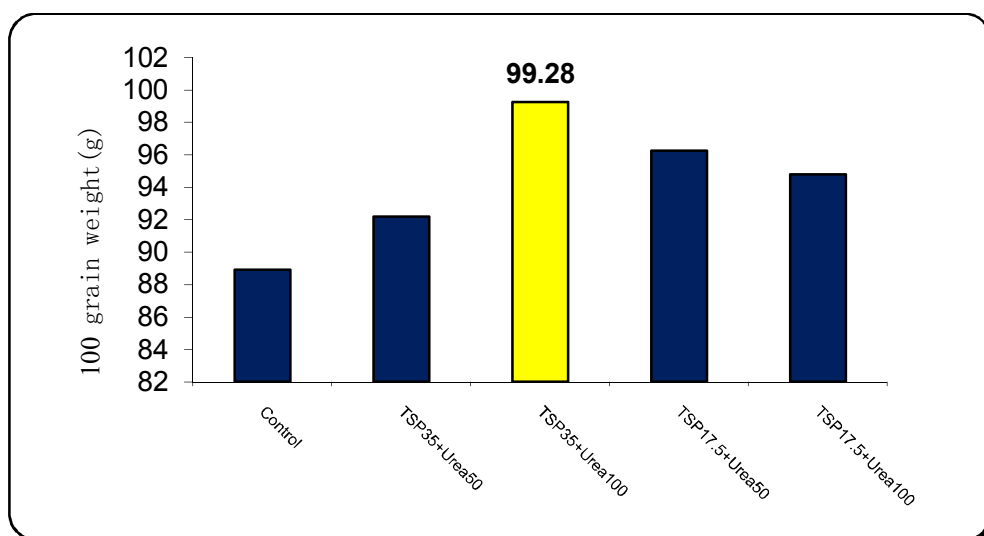
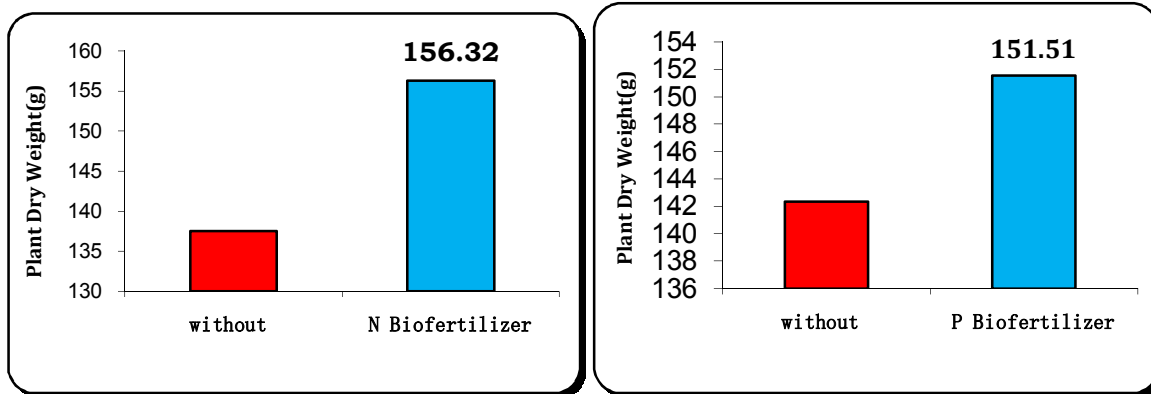
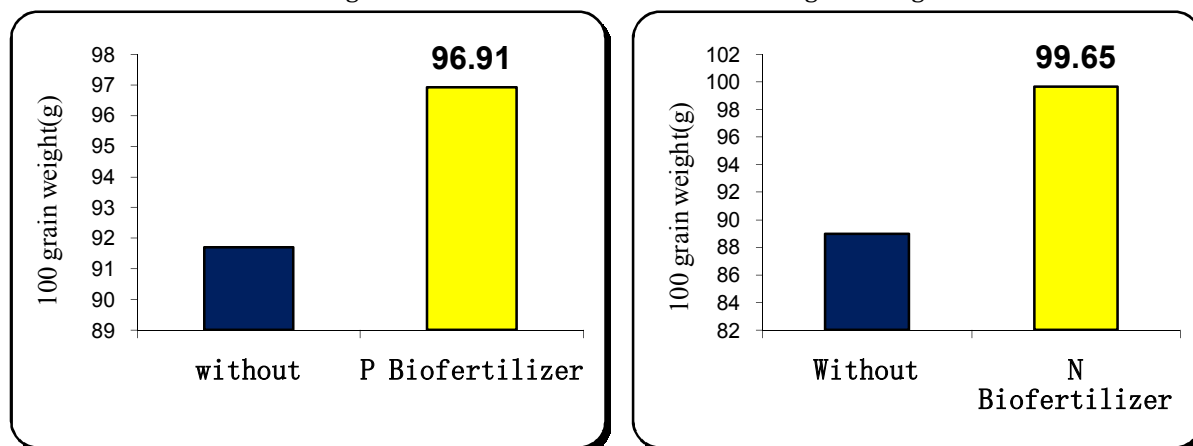


Fig.2. Effect of Mineral Fertilizer on 100 grain weight
 Fig.3. Effect of P and N Biofertilizer on 100 grain weight



The highest grain yield, 3.41 tons/ha, and weight of 100 grain, observed in treatments using inorganic fertilizer (35 TSP+100 Urea kg/ha) + nitrogen bio-fertilizer and without phosphorus bio-fertilizer (Fig.3) but the lowest grain yield was obtained in control treatment with 2.45 tons/ha (Fig.4). It could be concluded that under the same conditions, enrichment of faba bean plants with use of TSP+Urea fertilizer combined with N-fixers bacteria gave a considerable increase in yield and growth of faba bean plants.

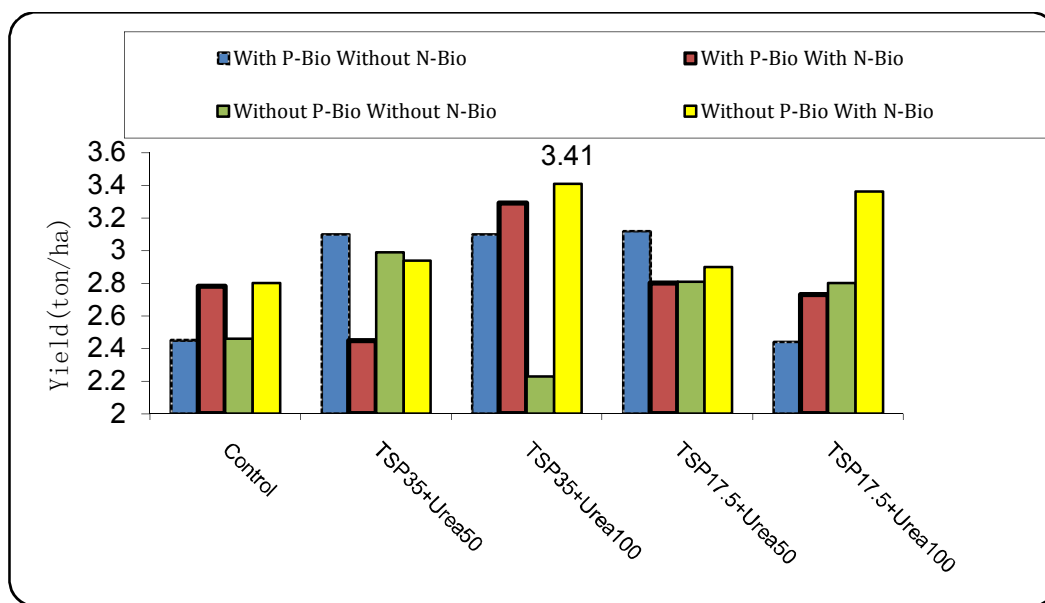


Fig.4. Effect of different treatment on yield of faba bean

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