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# Response of Some Varieties of Faba bean (*Vicia faba L.*) to Boron and Potassium

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**Abstract:** Field experiments use to investigate the effect of foliar application boron and potassium on growth, yield, yield components and chemical composition of two faba bean varieties. The results could be winterized as follows: Giza-3 variety surpassed Sakha-2 variety in all studied characters except seed yield, straw yield and K seed content. The results indicated spray foliar application of boron (150ppm), potassium sulfate (2%) and potassium phosphate (1.5%) significantly increased all the previous characters, with superiority the interaction with boron150ppm and potassium phosphate 1.5% which caused the highest increases in all characters ware under study.
**Key words :** faba bean- boron – potassium – seed content.

## Introduction

Field crop production in Egypt is concentrated mainly on the arable and around the banks of river Nile and the intensive agriculture system may lead to decreasing the productivity of unit-area. High demand of food in Egypt implies more production of food crops, including protein-containing crops, i.e. leguminous ones. Faba bean (*Vicia faba*, L.) is one of the major field crops grown in Egypt; it is an important source of protein for human and animal consumption and it plays a role in the crop rotation.

Boron is an important micronutrient not only human life but also the animal and plant. The essential nature role of B still understood, the evidence given by scientists showed that it is essential for plant growth and important in cell division.[1] The plants grown in B deficient or B toxic soils is poor quality compared with that of plants grown in B-sufficient soils this reveal the effectiveness of B in the Biological regulation which involves enzyme and hormone system. There is an increasing in sterility with boron foliar through studying of some vegetative and reproductive growth characters[2,3,4,5]. Spraying B led to increase the concentration of N, P, K and Na in the leaves, while it had no significant effect on N and P in leaf concentration.[6]

Potassium is an important macronutrients and the most abundant cation in higher plants. It is the target of many researches because it is essential for enzymes activation, protein synthesis and photosynthesis[7,8]. In addition to plant metabolism, potassium improves crop quality because it helps with grain filling and kernel weight, strengthens straw, increases disease resistance, and helps the plant better withstand stress[9].

## Materials and Methods

Two field experiments were carried out at the Research and Production Station, National Research Centre, El-Nubaria Province, El-Behira Governorate, Egypt during the two consecutive seasons 2013/2014 and

2014/2015. To study the effect of sprayed with boron (75and 150ppm) in form boric acid, potassium in form (potassium sulfate1and2%and potassium phosphate0.75and 1.5%) at 45 days from sowing and interaction between them on two varieties of faba bean (Sakha2 and Giza3)on growth, yield and its components grown under newly reclaimed sandy soil. The plants were collected after 90 days from sowing to determine the growth parameters. The experimental design was split plot in randomized complete block design where the variety treatments were allocated in the main plots whereas the foliar application were allocated in the sub plots.

**Statistical analysis:**

The responses of the treatments were compared by analysis of variance (ANOVA)[10]. Significant differences between the means of parameters were determined using Duncan's multiple range tests ($P \leq 0.05$). All analysis was carried out with SPSS software.

**Table (1): Mechanical and chemical analyses of experimental soil.**

| Sand% | Silt% | Clay% | CaCO3% | Organic matter% | E.C., dS/m | pH | oluble N% | Available P(ppm) | Available K(ppm) |
|---|---|---|---|---|---|---|---|---|---|
| 91.2 | 3.7 | 5.1 | 1.4 | 0.3 | 0.3 | 7.3 | 8.1 | 3.2 | 20 |

## Results and Discussion

Data presented in Table (2) indicated that Giza-3 cultivar surpassed Sakha-2 in plant height (80.66cm); number of branch/plant (3.6); number of leaves/plant (42.52) but Sakha-2 surpassed Giza-3 number of pods (14.55). These results agree with those of[11,12]. Results in Table (2) accentuate that foliar application of Boron (150ppm) followed by potassium sulfate (2%) or potassium phosphate (1.5%) were more effective in increasing vegetative growth. Obtained results are in agreement with those reported by[13,14]. The interaction between Boron (150ppm) and potassium phosphate (1.5%) give the highest value for all studied characters on growth compared with Boron (150ppm) and potassium sulfate (2%). The positive impact of potassium could be to its role in improving physical, chemical and biological condition of soil, its direct effect attributed due to its metabolic activity in plant growth. Therefore when plants were treated with potassium, chlorophyll contents were increased which enhanced overall photosynthetic activities of plants and thereby yield. These results are in agreement with[15] who reported that the addition of 50 kg $k_2SO_4$ / fed., to mung bean plants significantly increased stem length, number of branches/plant, number of pods/plant, 100-seed weight, seed yield/plant and seed yield/Fed.

**Table (2): Effect of Boron and potassium and interaction between them on some growth characters of faba bean**

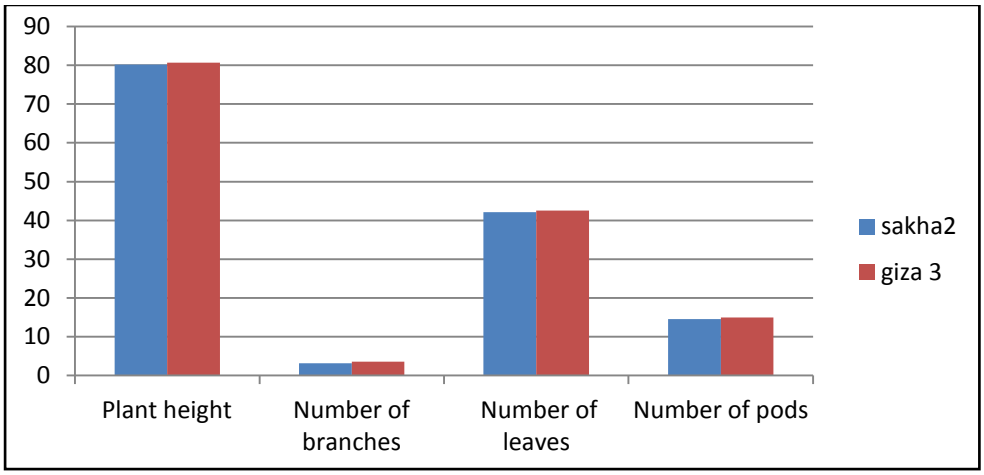
| Treatment | Plant height(cm) | | Numberof branches/plant | | Numberof leaves/plant | | Numberof pods | |
|---|---|---|---|---|---|---|---|---|
| | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 |
| **Boron 75 ppm** | 72.21 | 72.66 | 2.19 | 2.67 | 33.11 | 33.49 | 13.80 | 14.22 |
| **Boron 150 ppm** | 75.15 | 75.6 | 2.39 | 2.87 | 34.16 | 34.54 | 14.10 | 14.52 |
| **Potassium sulfate 1 %** | 74.21 | 74.66 | 2.25 | 2.73 | 33.41 | 33.79 | 13.16 | 13.58 |
| **Potassium sulfate 2 %** | 76.10 | 76.55 | 2.46 | 2.94 | 35.21 | 35.59 | 13.36 | 13.78 |
| **Potassium phosphate 0.75 %** | 79.11 | 79.56 | 2.66 | 3.14 | 36.19 | 36.57 | 13.15 | 13.57 |
| **Potassium phosphate 1.5 %** | 79.16 | 79.61 | 2.77 | 3.25 | 36.25 | 36.63 | 13.24 | 13.66 |
| **Boron 150ppm and Potassium sulfate 2%** | 80.01 | 80.46 | 3.11 | 3.59 | 41.51 | 41.89 | 14.10 | 14.52 |
| **Boron 150ppm and Potassium phosphate 1.5 %** | 80.21 | 80.66 | 3.12 | 3.6 | 42.14 | 42.52 | 14.55 | 14.97 |
| **Control** | 71.51 | 71.96 | 2.15 | 2.63 | 31.16 | 31.54 | 13.20 | 13.62 |
| **LSD treatment** | 16.2 | | 1.22 | | 18.2 | | 4.5 | |
| **LSD variety** | 12.8 | | 1.1 | | 16.4 | | 3.8 | |
| **LSD T. X V.** | 11.4 | | 0.81 | | 12.4 | | 2.4 | |

Data in Table (3) showed that Giza-3 cultivar surpassed Sakha-2 in weight of plant and weight of 100seeds but Sakha-2 exceed Giza-3 seed yield and straw yield. These results agree with those of[11,16,17]. Data presented in Table (3) indicated that increased weight of plant, weight of 100 seed, seed yield and straw yield

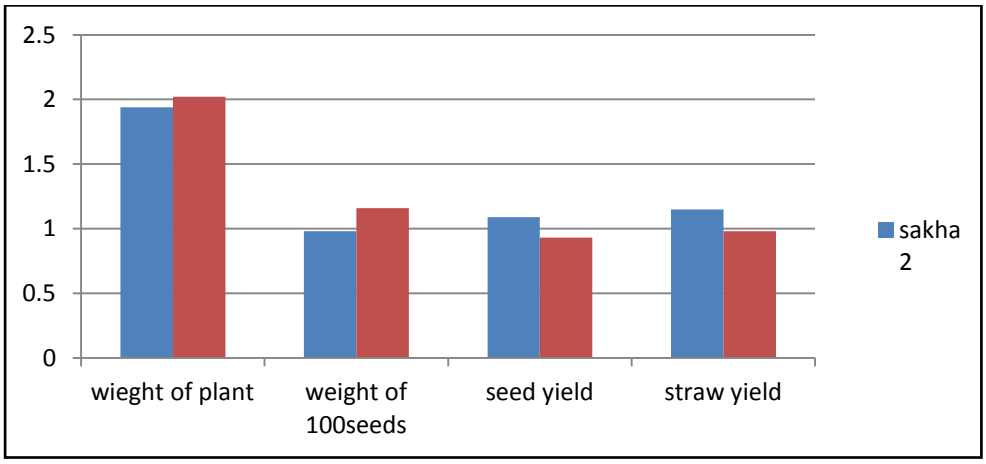
with increasing amount of boron applied the importance of boron application for good quality yield. The effect of K fertilization on yield of grain and straw of Faba bean were illustrated in Table (3). It increase yield progressively with increasing levels of potassium applied. Noticed fertilizer with potassium sulfate (2%) gives the high value in weight of plant, weight of 100 seed, seed yield and straw yield but boron (150ppm) and potassium phosphate (1.5%) gives the highest value in weight of plant, weight of 100 seed, seed yield and straw yield. This result is agreement with[18,19,20]. The interaction between Boron (150ppm) and potassium phosphate (1.5%) give the highest value for all studied characters on yield compared with Boron (150ppm) and potassium sulfate (2%).

**Table (3): effect of boron and potassium and interaction between them on some yield characters of faba bean**

| Treatment | weight of Plant (gm) | | weight of 100seeds(gm) | | seeds yield(ton/fed ) | | Straw yield(ton/fed) | |
|---|---|---|---|---|---|---|---|---|
| | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 |
| Boron 75 ppm | 1.63 | 1.68 | 0.86 | 0.82 | 0.65 | 0.67 | 0.62 | 0.64 |
| Boron 150 ppm | 1.86 | 1.71 | 0.89 | 0.95 | 0.62 | 0.69 | 0.68 | 0.67 |
| Potassium sulfate 1 % | 1.67 | 1.70 | 0.88 | 0.84 | 0.68 | 0.67 | 0.63 | 0.67 |
| Potassium sulfate 2 % | 1.88 | 1.72 | 0.89 | 0.96 | 0.75 | 0.78 | 0.66 | 0.79 |
| Potassium phosphate 0.75 % | 1.62 | 1.65 | 0.86 | 0.89 | 0.86 | 0.83 | 0.67 | 0.82 |
| Potassium phosphate 1.5 % | 1.80 | 1.69 | 0.88 | 0.93 | 0.89 | 0.85 | 0.71 | 0.86 |
| Boron 150ppm and Potassium sulfate 2% | 1.91 | 1.98 | 0.92 | 1.11 | 0.96 | 0.87 | 0.98 | 0.91 |
| Boron 150ppm and Potassium phosphate 1.5 % | 1.94 | 2.02 | 0.98 | 1.16 | 1.09 | 0.93 | 1.15 | 0.98 |
| Control | 1.65 | 1.66 | 0.85 | 0.62 | 0.42 | 0.63 | 0.61 | 0.63 |
| LSD treatment | 0.12 | | 2.4 | | 0.07 | | 0.06 | |
| LSD variety | 0.1 | | 2.1 | | 0.09 | | 0.08 | |
| LSD T. X V. | 0.09 | | 1.5 | | 0.05 | | 0.06 | |




**Fig(1) effect of boron (150ppm) and potassium phosphate (1.5%) on some growth characters of faba bean**




**Fig(2) effect of boron (150ppm) and potassium phosphate (1.5%) on some yield characters of faba bean**

The effects of different levels of boron, potassium and faba bean varieties and their interaction on seeds nutrient uptake per feddan are presented in Table (4and5). According to the data presented in Table (4and5) average seed nutrient uptake were significantly differed between treatments. It is clear that the highest values of seeds contents uptake were resulted from the addition of the highest rate of boron (150ppm), potassium phosphate (1.5%). Table (4and5) illustrates the different interaction effects between spray foliar and faba bean varieties on seed nutrients uptake, it is evident that there was significant effect on all seed nutrients accumulation. The data revealed that there were significant effects due to the interactions and it is clear regarding the interaction effects on seeds minerals content, it is evident that there was significant effect on all seed minerals accumulation.

In this respect[21,22,23,24,25] found that the use of bio-fertilizers induced significant increases in sesame plant growth, yield components and seed yield.

**Table (4): Effect of boron and potassium and interaction between them on some macro and microelements in seeds mg/kg.**

| Treatment | Protein | | nitrogen | | Phosphors | | potassium | | Magnesium | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | | |
| Boron 75 ppm | 25.62 | 26.25 | 4.1 | 4.2 | 0.74 | 0.75 | 1.6 | 1.7 | 40 | 42 |
| Boron 150 ppm | 26.87 | 28.12 | 4.3 | 4.5 | 0.78 | 0.76 | 1.7 | 1.9 | 45 | 46 |
| Potassium sulfate 1 % | 26.25 | 28.75 | 4.2 | 4.6 | 0.73 | 0.74 | 1.5 | 1.6 | 43 | 47 |
| Potassium sulfate 2 % | 28.75 | 30.62 | 4.6 | 4.9 | 0.75 | 0.76 | 1.7 | 1.8 | 46 | 49 |
| Potassium phosphate 0.75 % | 27.50 | 28.12 | 4.4 | 4.5 | 0.74 | 0.75 | 1.8 | 1.8 | 46 | 48 |
| Potassium phosphate 1.5 % | 28.12 | 29.37 | 4.5 | 4.7 | 0.76 | 0.76 | 1.9 | 2.0 | 49 | 50 |
| Boron 150ppm and Potassium sulfate 2% | 29.37 | 30.00 | 4.7 | 4.8 | 0.77 | 0.79 | 2.1 | 1.9 | 53 | 52 |
| Boron 150ppm and Potassium phosphate 1.5 % | 30.00 | 30.62 | 4.8 | 4.9 | 0.79 | 0.82 | 2.3 | 2.2 | 56 | 58 |
| Control | 25.00 | 25.62 | 4.0 | 4.1 | 0.72 | 0.72 | 1.4 | 1.5 | 38 | 41 |
| LSD treatment | 6.7 | | 2.14 | | 0.091 | | 1.24 | | 0.9 | |
| LSD variety | 8.3 | | 2.01 | | 0.092 | | 1.02 | | 0.6 | |
| LSD T. X V. | 4.2 | | 1.58 | | 0.085 | | 0.89 | | 0.07 | |

**Table (5): Effect of boron and potassium and interaction between them on some macro and microelements in seeds mg/kg.**

| Treatment | Ferric | | Zinc | | Mn | | Cu | |
|---|---|---|---|---|---|---|---|---|
| | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 | Sakha 2 | Giza 3 |
| Boron 75 ppm | 74 | 82 | 38 | 41 | 62 | 67 | 9 | 11 |
| Boron 150 ppm | 80 | 89 | 40 | 44 | 67 | 68 | 10 | 13 |
| Potassium sulfate 1 % | 77 | 87 | 42 | 43 | 65 | 69 | 12 | 12 |
| Potassium sulfate 2 % | 82 | 89 | 45 | 46 | 68 | 72 | 13 | 14 |
| Potassium phosphate 0.75 % | 81 | 86 | 45 | 47 | 68 | 71 | 11 | 13 |
| Potassium phosphate 1.5 % | 85 | 92 | 48 | 48 | 71 | 74 | 14 | 14 |
| Boron 150ppm and Potassium sulfate 2% | 87 | 94 | 51 | 53 | 74 | 78 | 13 | 15 |
| Boron 150ppm and Potassium phosphate 1.5 % | 89 | 96 | 54 | 58 | 79 | 81 | 16 | 17 |
| Control | 71 | 76 | 37 | 39 | 61 | 65 | 8 | 10 |
| LSD treatment | 62 | | 22 | | 13.4 | | 4.1 | |
| LSD variety | 57 | | 18 | | 10.3 | | 3.6 | |
| LSD T. X V. | 45 | | 13 | | 7.8 | | 2.2 | |

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