Effect of spraying with organic fertilizer (Fylloton) and boron on growth characteristics and yield of green beans grown in unheated plastic houses.

Ahlam Ahmed Hussein Abdalilah Hassan Ali
Diyala University / College of Agriculture / Department of Horticulture and landscape
abdalzuhaery@yahoo.com

Abstract

The experiment was carried out during the fall season 2019/2020 in one of the plastic houses belonging to the research station of the Department of Horticulture and Land scape / College of Agriculture / University of Diyala. Using a randomized complete block design (RCBD) as a factorial experiment consisting of two ingredients, the first ingredient is four concentrations of organic fertilizer (Fylloton), which are 0, 1, 2 and 3 ml. L^{-1} . The second ingredient is three concentrations of boron, 0, 50 and 100 mg. L^{-1} with three replications. The foliar spraying with organic fertilizer (Fylloton) 2 ml L^{-1} in recording the best results for plant height and total number of leaves, which were 301.01 cm and 71.66 leaves. $Plant^{-1}$, as for the foliar spraying with boron, 100 mg L^{-1} in giving the best results for number of total leaves, percentage of dry matter in leaves, yield per plant, and total yield were 69.27 leaves. $Plant^{-1}$, 23.85%, 1.40 kg. $Plant^{-1}$, 3.783 tons. the plastic house, area of 504 m, The best overlap treatment was F 2ml L^{-1} B 100 mg L^{-1}, which gave the highest values in all the characteristics studied in this research, compared to the comparison treatment, which recorded the lowest values in all the above-mentioned characteristics.

Keywords: organic fertilizer, green beans, boron, plastic houses.

Introduction

The green bean, *Phaseolus vulgaris* L., belongs to the Fabaceae family, which is one of the largest plant families. The genus phaseolus includes about 150 species of annual and perennial plants that spread in the tropics of Africa, Asia and South America(Hassan, 1989). For consumption of green pods or for dry seeds or grown for both purposes (Al-syed, 2006), and it is one of the most important legumes for human food and provides a large part of his need of protein, as the protein of beans contains essential amino acids and high concentrations of folic acid (Marwa *et al*., 2002). The bean plant is characterized by its need for large quantities of major nutrients to obtain high production, which prompts farmers to add large quantities of chemical fertilizers that have a negative effect on the environment, and their exaggeration leads to a decrease in the productivity of the crop (Veltcheva *et al*, 2005), hence the Feeding with organic fertilizers is not only a means to improve productivity, but also an important tool to reduce the amount of chemical fertilizers added . It was found that the addition of organic fertilizers to irrigation water led to a reduction in the amount of chemical fertilizers to be added to the crop by 50% and improved the vegetative growth and the productivity and quality of both green pods and dry seeds. Studies indicated the possibility of adding organic fertilizers by spraying or with irrigation water. Depending on the speed of the plants' response to one of these methods and the concentration of the fertilizer (Magdi *et al,* 2011). The method of foliar fertilization is efficient and effective in feeding plants for the speed of absorption of nutrients by the vegetative parts, in addition to that it supplies plants with nutrients in a homogeneous manner, especially the important mineral elements that greatly affect the conduct of vital processes within the plant Boron is one of these elements that plays an important role In plant growth, it is one of the components of the cell membranes, and most plants often fail to produce the normal rate of seeds in cases of deficiency due to the lack of pollen germination and the fall of buds and flowers, and thus a decrease in fruits and the quantity of seeds produced (Ibrahim, *et al*, 2014). Thavaprakaash *et al* (2006) mentioned that

 ISSN 2072-3875

boron is one of the most dangerous micro nutrients for plants in causing toxicity in case of deviation from the appropriate concentration, even if it is slight.

the research aims to increase the productivity of green beans through the use of foliar spraying with organic fertilizer (Fylloton) and boron, knowing the appropriate concentration of each, and determining the effect of the interaction between them on the characteristics of vegetative growth and yield of beans grown under the conditions of plastic houses.

Materials and methods

The experiment was carried out during the fall season 2019/2020 at the Research Station of the Department of Horticulture and landscape /College of Agriculture/University of Diyala. The soil of the field was prepared by conducting plowing, smoothing and leveling operations. Animal manure was added during the soil preparation operations at an amount of 10% with chemical fertilizer, which is Dap fertilizer N 18, P 46 at a rate of 4 kg and after mixing it with the soil, the plastic house, which has an area of 504 m, was divided into a length of 56 m and a width of 9 m to 6 terraces, and the distance between the centers of two adjacent terraces was 80 cm, As for the service corridor, it was 50 cm wide. The plants were planted next to the irrigation pipes, at a distance of 25 cm between one plant and another. The system followed was T-Tape drip irrigation. The soil of the house was analyzed by taking samples from several different areas of the field before planting and at a depth 30 cm in the laboratory of the Diyala Directorate of Agriculture, and Table 1 shows some physical and chemical properties of the soil of the plastic house before planting. Climbing green bean (GIA BEAN) seeds, produced by the American company Catalyst Seeds, were sown directly in the soil on 20/11/2019 at the rate of two seeds per hole, with a distance of 25 cm between one hole and another. Irrigation, weeding, hilling, bush control and disease control are equal for all experimental units.

Table 1: Some physical and chemical properties of agricultural soil

soil characteristics		**units**	**the value**
pH		**.....**	7.05
(1-1) EC		Ds m^{-1}	7.43
Ready items	Nitrogen	mg/kg $^{-1}$	54.03
	phosphorous		8.044
	potassium		81.789
	Boron		5.23
Organic matter		g/kg $^{-1}$	6.9
$CaCo_3$			260.2
Soil Separators	sand		286.6
	silt		591.2
	mud		122.2
soil texture		**Silty loam**	
field capacity		%	25
Virtual density		g. cm3	1.35

Experimental design:

The experiment was designed according to the Randomized Complete Block Design (RCBD) as a factorial experiment consisting of two ingredients with their interactions: The first organic enriched ingredient (Fylloton) with four concentrations of 0, 1, 2 and 3 ml. L^{-1} is symbolized by F_0, F_1, F_2, F_3 The second ingredient is three concentrations of boron, which are 0, 50 and 100 mg. L^{-1} and symbolized by B_0, B_1, B_2 Thus, the number of

 ISSN 2072-3875

experiment treatments becomes 12 with 3 replicates, and thus the number of experimental units becomes 36 units The results were analyzed according to the SAS program and the averages were compared according to the Duncan polynomial test at a probability level of 0.05 (Al-Rawi and Khalafallah, 2000).

The organic fertilizer (Fylloton), and boron (boric acid) which contains 17% boron, were sprayed by 4 times during the growing season. The first spray was a month after planting and the second spray was 15 days after the first spray, and so the sprays rolled every 15 days between one spray and another, taking into account that the organic fertilizer was sprayed one day and boron on the next day immediately, and spraying was on the vegetative growth using a dorsal sprinkler in the early morning with the use of a diffuser substance (liquid), in order to reduce surface tension and ensure that the solution remained on the leaves as long as possible. Table 2 shows the ingredients of the organic fertilizer used in the experiment.

Table 2: ingredients of the organic (Fylloton) used in the experiment

Components	wt/wt %		G /L
organic nitrogen	6 %		76.2
organic carbon	25.2 %		320
amino acids			
glumalic acid	25.39	Proline	1.47
Aspartic acid	13	glycine	10.08
vinyl alanyl	3.47	tryptophan	0.87
valine	3.52	Isoleucine	3.68
leucine	5.98	arginine	2.09
methionine	1.72	threonine	4.77
tarozine	3.31	serine	4.85
Hydroxyproline	4.39	histidine	1.67
cysteine	1.46	alanine	3.89
pH	0.5±6.9	Density	1.27 kg/l

Results and discussion

plant length (cm)

The results of Table 3 showed that there were significant differences between the treatments of spraying with organic fertilizer (Fylloton). The two treatments F_2 and F_3 were superior in giving them the highest plant height, which did not differ significantly from each other, and they were 301.01 and 291.40 cm, respectively, while the lowest plant length was when the control treatment was 270.95 cm, which did not differ significantly from the F_1 spray treatment. The results of the same table indicated that there were no significant differences between plants spraying treatments with boron in plant length. The interaction between the organic fertiliser and boron had a significant effect on plant length, as the treatment F_2 B_2 excelled in recording the highest plant length of 311.78 cm, while the lowest plant height was in the treatment F_0 B_0, which amounted to 261.66 cm**.**

 ISSN 2072-3875

Table 3: Effect of spraying with organic fertilizer (Fylloton) and boron and the interaction between them on plant length (cm)

		Boron concentrations (mg. L^{-1})			**Organic Averages**
		B_0	**B_1**	**B_2**	
Organic Fertilizer Concentrations (ml. L^{-1})	**F_0**	261.66 d	276.66 cd	274.53 cd	270.95 B
	F_1	271.00 cd	271.00 cd	274.11 cd	272.03 B
	F_2	287.26 bc	304.00 ab	311.78 a	301.01 A
	F_3	300.43 ab	287.66 bc	286.11 bc	291.40 A
Boron averages		280.09 A	284.83 A	286.63 A	

The averages with similar letters do not differ from each other significantly according to Duncan's polynomial test at the 0.05 level of probability

Total number of leaves (leaf. plant^{-1})

It is noted from the results of Table 4 that the spray treatment with organic fertilizer (Fylloton) F_2 was superior to a concentration of 2 ml L^{-1} gave it the highest number of total leaves, reaching 71.66 leaves. Plant^{-1}, while the comparison treatment recorded the lowest number of total leaves that reached 54.73 leaves. Plant^{-1}. Treatments of spraying plants with boron showed a significant increase in the number of total leaves, and treatment B_2 was superior in giving the most number of leaves, reaching 69.27 leaves. Plant^{-1}, while treatment B_0 recorded the lowest number of leaves, reaching 59.91 leaves. plant^{-1}. As for the interaction between the studied workers, it had a significant effect on the number of total leaves, and the treatment F_2 B_2 excelled in giving it the most number of total papers, which amounted to 76.44 leaves. Plant^{-1}, while treatment F_0 B_0 and F_0 B_1 recorded the lowest number of leaves, which were 51.33 and 50.44 leaves. Plant^{-1}, respectively .

Table 4: Effect of spraying with organic fertilizer (Fylloton) and boron and the interaction between them on the number of total leaves (leaf. Plant^{-1})

		Boron concentrations (mg. L^{-1})			**Organic Averages**
		B_0	**B_1**	**B_2**	
Organic Fertilizer Concentrations (ml. L^{-1})	**F_0**	51.33 f	50.44 f	62.44 d	54.73 C
	F_1	55.77 e	72.33 b	67.11 c	65.07 B
	F_2	72.11 b	66.44 c	76.44 a	71.66 A
	F_3	60.44 d	67.77 c	71.11 b	66.44 B
Boron averages		59.91 C	68.24 B	69.27 A	

The averages with similar letters do not differ from each other significantly according to Duncan's polynomial test at the 0.05 level of probability

ISSN 2072-3875

The percentage of dry matter in the leaves

The results of Table 5 show that there was no significant increase in the percentage of dry matter in leaves when spraying with organic fertilizer for all concentrations, but it was the best at F_3 and reached 22.15%. It was also observed from the results that spraying plants with boron led to a significant increase in the percentage of dry matter in the leaves, and treatment B_2 recorded the highest percentage of dry matter in the leaves, which amounted to 23.85%.

The result of the interaction between the studied workers showed a significant effect in the percentage of dry matter in the leaves when treatment F_2 B_2 amounted to 25.40%, compared to the comparison treatment that recorded the lowest percentage of dry matter in the leaves amounted to 12.95%.

Table 5: Effect of spraying with organic fertilizer (Fylloton) and boron and the interaction between them on the percentage of dry matter in the leaves

		Boron concentrations (mg. L^{-1})			**Organic Averages**
		B_0	**B_1**	**B_2**	
Organic Fertilizer Concentrations (ml. L^{-1})	**F_0**	12.95 d	16.99 bcd	25.08 ab	18.34 A
	F_1	15.69 cd	21.31 abc	23.84 abc	20.28 A
	F_2	16.12 bcd	21.26 abc	25.40 a	20.93 A
	F_3	25.79 a	19.59 abcd	21.07 abcd	22.15 A
Boron averages		17.64 B	19.79 B	23.85 A	

The averages with similar letters do not differ from each other significantly according to Duncan's polynomial test at the 0.05 level of probability

Discussing vegetative characteristics

The results of Tables 3, 4, 5 showed that foliar spraying with organic fertilizer concentration of 2 ml. L^{-1} had a significant effect on most vegetative growth characteristics, and the reason may be due to the content of organic fertilizer (Fylloton) of organic nitrogen and carbon, which had a (Table 2) effect on most of the functional processes of the plant, which leads to an increase in cell division and elongation of cells (Nardi, *et al*, 2002), which was positively reflected on the length of the plant and the number of leaves (Maalla, *et al*, 2015), or perhaps the reason is due to the content of the organic fertiliser of amino acids (Table 2) within its composition, which plays an important role in plant nutrition and because of its important physiological effects in vital processes especially Critical periods in the life of the plant, and amino acids play an important role in opening and closing the stomata, as the process of opening the stomata increases the efficiency of photosynthesis and thus the accumulation of carbohydrates in the tissues of the plant, which eventually led to an increase in the wet and dry matter in the leaves (Farahi *et al*, 2013).

The results of the above tables also indicated that boron concentrations had a significant effect on most of the studied characteristics of green bean plants, as the concentration exceeded 100 mg.L^{-1} in recording the best results. The reason for the superiority of boron treatments in vegetative growth indicators may be due to the role of boron in building a highly efficient root

 ISSN 2072-3875

system in absorbing macro and micro nutrients and increasing their concentration inside the plant (Aydn and Sevine, 2010). Boron also has an important role in the formation of proteins in the plant through the formation of RNA, the work of membranes, nitrogen metabolism and photosynthesis, and the increase in the amount of manufactured materials in the leaves of carbohydrates and proteins needed to build plant tissues and soft weight (Abu Dahi and Al-Younes, 1988), and boron improves many physiological processes And biochemical by activating meristematic tissues, increasing cell division and elongation, and increasing the production and effectiveness of growth regulators, which is positively reflected on vegetative indicators and their increase (Ali *et al*, 2014). Boron also has an effective role in plants through its effect on the effectiveness of the cell membrane in the absorption of nutrients such as nitrogen, phosphorous and potassium and its great role in growth and regulation of the vital activities of the plant (Salih, 2013). This is a result of the fact that boron improves the vegetative growth of plants as it enters the vital processes of the auxin hormone and the production and availability of growth regulators such as gibberellin and cytokinin, and each of them has an effect on cell division and elongation (Muhammad, 2014). Balanced nutritional status.

Yield per plant (kg. Plant^{-1})

The results in Table 6 show that there were no significant differences in the yield of one plant when spraying with organic fertilizer (Fylloton). As for spraying with boron, spraying performed at a concentration of 100 mg. L^{-1} treatment B_2 gave the highest yield of the plant amounted to 1.407 kg. Plant^{-1}, while treatments B_0 and B_1 did not differ significantly from each other, they recorded 1.112 and 1.197 kg. Plant^{-1}, respectively. With regard to the interaction between the organic fertilizer and boron, both treatments F_2 B_2 and F_0 B_2 were superior in giving them the highest yield per plant of 1.50 kg. Plant^{-1} for each, while treatment F_0 B_0 recorded the lowest yield per plant, which was 1.00 kg. plant^{-1}.

Table 6: Effect of spraying with organic fertilizer (Fylloton) and boron and the interaction between them on the yield of one plant (kg.plant^{-1})

		Boron concentrations (mg. L^{-1})			**Organic Averages**
		B_0	**B_1**	**B_2**	
Organic Fertilizer Concentrations (ml. L^{-1})	**F_0**	1.000 b	1.100 ab	1.500 a	1.200 A
	F_1	1.130 ab	1.300 ab	1.330 ab	1.253 A
	F_2	1.060 ab	1.130 ab	1.500 a	1.230 A
	F_3	1.260 ab	1.260 ab	1.300 ab	1.273 A
Boron averages		1.112 B	1.197 B	1.407 A	

The averages with similar letters do not differ from each other significantly according to Duncan's polynomial test at the 0.05 level of probability

- Total yield (tons. house^{-1})

The results of Table 7 show that there are significant differences in the total yield when spraying with organic fertilizer (Fylloton), as the treatment F_3 excelled at a concentration of 3 mg.L^{-1} in giving it the highest yield amounting to 3.422 tons. house^{-1}, and the F_0 treatments recorded the lowest yield amounting to 3.224 tons. house^{-1}. Treatment of plants spraying with boron led to a significant increase in the total yield, and treatment B_2 was superior in giving it the highest yield amount of 3.78 tons.house^{-1}, while treatment B0 recorded the lowest yield of 2.989

 ISSN 2072-3875

tons.house^{-1}. As for the interaction treatment between organic fertilizer (Fylloton) and boron, it had a significant effect on the total yield. The treatment F_2 B_2 recorded the highest value of 4.032 tons.house^{-1}, while the comparison treatment F_0 B_0 recorded the lowest value of 2.687 tons.house^{-1}.

Table 7: Effect of spraying with organic fertilizer (Fylloton) and boron and the interaction between them on the total yield (ton.house^{-1})

		Boron concentrations (mg. L^{-1})			Organic Averages
		B_0	**B_1**	**B_2**	
Organic Fertilizer Concentrations (ml. L^{-1})	**F_0**	2.687 d	2.956 c	4.031 a	3.224 C
	F_1	3.037 bc	3.494 b	3.575 b	3.368 B
	F_2	2.849 c	3.037 bc	4.032 a	3.306 BC
	F_3	3.386 b	3.386 b	3.494 b	3.422 A
Boron averages		2.989 C	3.218 B	3.783 A	

The averages with similar letters do not differ from each other significantly according to Duncan's polynomial test at the 0.05 level of probability

The results in Tables 6 and 7 indicate the superiority of foliar spraying with organic fertilizer (Fylloton) in most of the yield characteristics. The reason may be due to the role of the elements contained in the extract from nitrogen and carbon, which led to an increase in the characteristics of vegetative growth and an increase in the efficiency of the photosynthesis process, thus increasing the characteristics of the crop. It is due to the role of the amino acids present in the extract, which are easily released for the plant to benefit from quickly and easily enter the cytoplasm of cells, which leads to an increase in the photosynthesis process as a result of its entry into the composition of a number of enzymes for this process (Zaidan and Diop, 2005), and amino acids play an important role in stimulating cell growth (Maalla *et al*, 2015), Moreover, it can serve as a source of carbon, energy and the manufacture of other organic compounds, such as protein, amines, purines, alkaloids, vitamins, enzymes, turbines (Abdolzadeh *et al*, 2006). The concentration exceeded 100 mg.L^{-1} in the yield of one plant. The reason for the superiority of boron treatments in these characeristics may be due to its direct effect on the flowering and fertilization processes, as the vitality of the female parts increases with the availability of boron and its positive role in the germination of pollen grains and the formation of the pollen tube, as well as the speed of cell division after contract, which is positively reflected in the increase in plant production (Huang *et al*, 2000). The ability of boron to increase the efficiency of the plant in increasing the dry matter and making it the final downstream of the manufactured materials, has positively affected the production of the plant, which is reflected in one way or another on the increase in the yield of the plant and then the increase in the total production (Al-Issawi,2010). Boron also has a positive effect in improving the ion transport system of the plant, which contributes to the efficiency of ion absorption, increases the vital activity of the plant and encourages the formation of an efficient vegetative system in the absorption and assimilation of nutrients (Barker and Pilbeam, 2007). It also leads to the rapid processing of nitrogen and its activation by the carbon metabolism process (Pandey and Gupta, 2012), as the same tables indicated that the interaction treatment between the organic

 ISSN 2072-3875

fertilizer concentration of 2 ml. L^{-1} and boron 100 mg. L^{-1} in most of the yield characteristics and its components was superior. Each of them had a significant impact on the biological activities of the plant, which was positively reflected in these characteristics . This is consistent with what was found by Aslani and Souri (2018). The treatment of green beans grown under greenhouses with organic fertilizer led to a significant increase in plant height and dry weight, which was positively reflected on the yield of one plant and the total yield.

Conclusions

1. The foliar spray with organic fertilizer (Fylloton) concentration of 2 ml. L^{-1} was the best in improving most of the vegetative and productive characteristics of green beans.
2. The boron foliar spray achieved a concentration of 100 mg. L^{-1} had the best response to green bean plants, and this was reflected positively in most growth and yield characteristics.
3. The binary interaction between the organic fertiliser (Fylloton) had a concentration of 2 ml. L^{-1}, boron concentration is 100 mg. L^{-1} The obvious effect in improving most of the characteristics of green beans grown in unheated greenhouses.

Competing Interests: The authors declare that they have no competing interests.

Acknowledgments : The authors acknowledge the staff of research station at Department of Horticulture. College of Agriculture. University of Diyala to assist in field service operations

References

Abdolzadeh, A., Hosseinian, F. Aghdasi, M. and H. Sadgipoor. 2006**.** Effect of nitrogen sources and levels on growth and alkaloid content of periwinkle. Asian Journal of Plant Science , 5 (2) : 271=276.

Abu Dahi, Y, M., M, A, Al-Younis. 1988 . Plant Nutrition Guide. Ministry of Higher Education and Scientific Research, University of Baghdad, Iraq. 122-138 p.

Ali, N, S., H,S Rahi. and A, A, Shaker. 2014. soil fertility. Scientific Books House for printing, publishing and distribution. Baghdad, Iraq . 307 p.

Al-Issawi, Y, J, A. 2010. Effect of foliar feeding with boron and zinc on the growth and yield of six cultivars of bean. PhD thesis, Faculty of Agriculture. Baghdad University. Iraq.

Al-Rawi, K, M., A, M, Khalaf Allah. 2000. Design and analysis of agricultural experiments. Dar Al-Kutub for Printing and Publishing, College of Agriculture and Forestry, University of Mosul. Iraq.

Al-Syed, S.F. 2006. Vegetable Production Technology Inside The greenhouses and Tunnels in The desert Land. Egyptian Library, Alexandria, Egypt. pp. 478 .

Aslani, M. and M.K. Souri . 2018 . Growth and Quality of Green Bean (*Phaseolus Vulgaris* L.) under foliar application of organic -chelate fertilizers. DEGRUYTER open Agriculture. 3(1) :146 – 154

Aydn, A. and A. Sevinc. 2010. The effect of boron (B) application on the deficient soils. growth and nutrient contents of maize in Zinc (Zn) Research Journal of Agriculture and Biological Sciences. 2(1): 1-4

Barker, V. Allen, and D.J. pilbeam. 2007. Handbook of Plant Nutrition. CRC Taylor & Francis Group

Farahi. M. H., A. Aboutalebi, S. Eshghi, M. Dastyaran and F. yosefi. 2013. Foliar application of humic acid on quantitative and qualitative characteristics of (Aromas) strawberry in soilless culture. Agricultural, Communications, 1(1): 3-16.

Hassan, A. A.1989. Fruiting Vegetables. Dar Al Arabia for Publishing and Distribution, In: Soil Testing and plant Analysis. ed . by walsh ,L.M. and J.D .Beaton. Soil Science Society of America, Inc ,677 South Segee Rd , Madison ,Wiscon sin ,USA .

 ISSN 2072-3875

Huang, L., J. Pants., B. Dell. and R.W. Bell. 2000. Effects of boron deficiency on anther development and floret fertility in wheat (*Triticum aestivum* L. 'Wilgoyne'). Ann. Bot. 85: 493-500.

Ibrahim, H, M. 2010 Plant samples collected and analyzed. Minia University. Cairo. Egypt. 534 p.

Magdi, T.A., E. M. Selim and A.M. El-Ghamry. 2011. Integrated effect of bio and mineral fertilizers and humic substances on growth،yield and nutrient contents of fertigated cowpea (*Vigna unguiculata* L.) grown on sandy soils. Journal of Agronomy, 10(1): 34-39.

Marwa, S., A. H, Sh. M. selim, .A.Ragab and E.A.saleh. 2002. Inoculation as aprime Factor affecting successful nodulation of Common bean (*Phaseolus Vulgaris* L). Arab Vniv.J.Agric, Sci, Ain Shams uniu. Cairo. 10 (2) : 521-541.

Maalla, G., N, Safaa. and B, Samra. 2015. The effect of feeding with different methods and concentrations of the organic fertilizer Humax on the growth and productivity of the bean plant (*phaseolus vulgaris* L) Journal of Damascus University for Agricultural Sciences, 31(2): 39-50.

Muhammad, H, A. 2014. Effect of supplemental irrigation and spraying with potassium and boron on the quantitative and qualitative characteristics of the bean plant *(Vicia faba* L.). Diyala Journal of Agricultural Sciences. 6 (1) 201-187

Nardi. S., D. Pizzeghello, A. Muscolo and A. Vianello. 2002. Physiological effects of humic substances on higher plants. Soil Biol. Biochem, 34(11):1527-1536.

Pandey, N., B. Gupta. 2012. The Impact of foliar boron sprays on reproductive biology and seed quality of black gram. Journal of Trace Elements in medicine and Biology. 27 (1) : 58-64.

Salih. H. O. 2013. Effect of foliar fertilization of Fe, B and Zn on nutrient concentration and seed protein of cowpea IOSRJ Agricultural Veterinary.Scienc;6:42-46

Thavaprakaash, N.,K.Velayudham and S.Panneerselvam. 2006.Foliar nutrition of baby corn (*Zea Mays* L.) Archives Of Agronomy and Soil Sci .52(4):419-425 **.**

Veltcheva, M., D.Svetleva, Sp. Petkova and A.Perl. 2005. In vitro regeneration and genetic transformation of common bean (*Phaseolus vulgaris* L.) Problems and progress. Scientia horticulturae, 107(1): 2–10

Zaidan, R., S, Diop. 2005 . The effect of some humic substances and amino acid compounds on the growth and production of regular potatoes (*Solanum Tuberosum* L.), Tishreen University Journal for Research and Scientific Studies. Biological Sciences Series.27(2):91-100.