Effect of Compost, Mineral Fertilizers and Foliar Application of Micronutrients on Mineral Compositions and yield components of Bean (*Phaseolus Vulgaris L.*) under Alluvial Soil Condition

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Abstract

Bean (*Phaseolus vulgaris L.*) is considered one of the most important legume crops in Egypt. It is used for human consumption as a good source of vegetarian protein. Hence, a field experiment was done by used bean (*Phaseolus vulgaris L.*).CV Bohera during the season of 2015 at the Agricultural Experimental Station, Mansoura University, Egypt to study the effect of compost,mineral fertilizers and foliar application of some micronutrients on mineral composition of bean plant as well as grain components (total Carbohydrate% and Crude Protein content%). Complete block design with four replicates and nine treatments was used in this study. Treatments were Control, NPK100 %, NPK75 %, NPK100 %+ Compost, NPK75% +Compost, NPK100% Manni plex beans, NPK75 % + Manni plex beans, NPK100 %+ compost + Manni plex beans, NPK75%+ compost + Manni plex beans. The obtained results showed that over treatments under study superior and significant increase was recoded with the treatment of NPK 100% +compost + Manni plex beans compared with other treatments. Thus, foliar application of Fe, Zn, B and Mn with other amendments led to positive increases of macronutrients (N, P and K) and micronutrients (Fe, Zn and Mn) concentration in leaves, stem and root of bean, In addition to, all tested treatments significant improved seeds

Key words : *Bean, foliar application, compost, NPK fertilizer, nutrient concentrations. yield components*

1. Introduction

Bean (*Phaseolus vulgaris L.*) is one of the most important vegetables, fresh market and seeds crop in the world. Bean seeds contain high amounts of proteins, minerals, and vitamins. In Egypt, beans plant plays a chief role as one of the strategic crops due to it's important for soil fertility, its

income to the farmers, human nutrition as a rich source of vegetarian protein, animal feeding, and industry purposes [1]. It represents around 60000 feddans (feddan = 0.4 hectare), of Egyptian cultivated area with overall production of 28530 tons [2].

Soil amendments known as any organic and inorganic substances mixed into the soil for achieving a better soil constitution which can be physical, chemical or biological properties to allow healthy crop growth [3]. Compost is an aerobically decomposed organic material consequent from plants and animal sources by mesophilic and thermophilic microorganisms [4].Using compost by a rate of 20 and 80 ton. ha^{-1},especially with 80 ton.ha^{-1} to soil increased plant nutrient uptake and elements movement in soil which reflex a positive effect on plant growth [5]. In a study by [6] reported that soils fertilized with composts showed an increases in quantity (TOC) and quality (humic acids) of organic matter compared to inorganically fertilized soil.

Nitrogen, phosphorus and potassium are essential nutrients, especially for legumes, phosphorus and nitrogen can play a key role in improving plant growth and phosphate uptake efficiency by releasing phosphorus from rock or tri-calcium phosphate [7]. Similarly, Potassium is one of the major elements in plants. Thus, there are relationship between yield and potassium applications.

[8] Studied the effect of organic matter (humic acid 20 g/l) on growth and chemical composition of snap beans plant cv. The obtained results indicated that application of humic increased (plant height, number of leaves and branches/plant, leaf area as well as dry weight of shoots and roots), and in shoots, P, K, Ca, Mg, Zn and Fe concentrations significantly increased in leaves.

In cultivated areas, the use of organic fertilizers together with inorganic fertilizers, compared to the addition of organic fertilizers alone, increases production by improving physical, chemical and biological properties of soil. Application of organic matter provides nutrients such as N, P, K and Ca to the soil, improve aggregate stability and enhance water holding capacity as well as helps the soil to maintain good tilth and thereby better aeration for germinating seeds and plant root development [9,10].

Bean are very sensitive to soil deficiency of micronutrients because of their involved in the key

physiological processes of photosynthesis and respiration. and their deficiency can impede these vital physiological processes and consequently limiting yield gain. For example, iron (Fe) plays a crucial role, being a cofactor of enzymes of the reductive assimilatory pathway as well as Manganese (Mn) plays an essential role in photosynthesis, net assimilation and relative growth[11].[12] Reported that "When leaf or shoot zinc concentrations are below 15 mg/kg tissue, plants show very quick reductions in growth and a severe decline in yield and the leaf concentrations of soluble protein and yield of crop plants". The main aim of this study was to examine the influence of compost, mineral fertilizers and foliar application of micronutrient on nutrients concentrations of bean (*Phaseolus Vulgaris L.*) in clay loam soil as well as yield components.

2. Materials and Methods

Field experiment was performed during the 2015 growing season at the Agricultural Experimental Station Mansoura University, Egypt, to investigate concentrations of some macronutrient and micronutrient of bean (*Phaseolus Vulgaris L.*) by using compost, mineral fertilizers and foliar application of micronutrient under alluvial soil conditions**.**

2. 1 Analysis of compost

The compost was used as organic fertilizers in this study, it was added at a rate of 20 m^3 fed^{-1}. The compost was taken from Horticulture Department, Mansoura University, according to [13] ,analysis of compost is shown in table (1).

Table .1 Analysis of compost

Parameters	EC 1:10	pH 1:10	OM g/kg	OC g/kg	TN g/kg	C/N ratio	TP g/kg	TK g/kg	SP %
	3.69	6.09	382	222	13.9	16:1	5.1	4.5	178

2. 2 Samples and analysis of soil and plant.

Soil samples were taken at the harvest from each plot and then were taken to the laboratory to be air dried, grinned and passed through 2 mm sieve and stored for soil analysis. Soil analyses is

revealed in table (2).

Table 2. Analyses of the experimental soil.

Mechanical analysis (%)			Texture	Physical and chemical properties of tested soil. (Parameters)					Avail. nutrients mg/kg		
Sand	**Silt**	**Clay**	**Clay loam**	**EC dS/m** 1:5	**pH** 1:2.5	**SP (%)**	**O.M g/kg**	**$CaCO_3$ (%)**	**N**	**P**	**K**
30.33	35.51	34.16		1.07	8.12	62.5	17.3	4.16	46.5	10.14	150.3

Plant samples were taken at two stages, the first at the vegetative growth stage (the whole plant was taken to analysis) and the second was at the harvest stage, where leaves, straw, roots and seeds were separated, and stored for analysis. Plant samples were taken from each plot, after that the plant parts were dried at 70 C^o and the dry weight was recorded. The plant parts were grinned to fine powder and 0.2 g was wet digested with a mixture of sulfuric acid (H_2SO_4) and perchloric acid ($HClO_4$) for the different analysis (i.e. N, P and K).

The N, P, and K(%) and Zn, Mn and Fe (mg/kg) concentrations were determined in oven dry plant samples at booting in the whole plant and at harvest in both separated organs of leaves, straw, roots and seeds. N, P and K nutrients were measured in the digestive extract and their percentage were calculated on oven dry matter. Minerals estimation were performed as follow:-

- Nitrogen was determined by the micro-kjeldahl method as aforementioned by [14].
- Phosphorus was determined colorimetrically at a wavelength of 660nm using stannous chloride reduced molybedo phosphoric blue color method, described by [13].
- Potassium was determined using Gallen Flam photometer as described by [13].
- Micronutrients (Zn, Mn and Fe) were measured by these elements in digest resting from HNO_3 acid in the digested plant samples using an Atomic Absorption Spectrophotometer according to [15].

2. 3 Total carbohydrates %

It was determined according to [16].

2. 4 Protein content and Vitamin C (V.C)

Protein content in grains was calculated by multiply N percentage by 6.25 according to Association of Official Analytic Chemists [17].

2. 5 Mineral Fertilizers

Nitrogen fertilizers were ammonium sulphate $(NH_4)_2SO_4$ added at a rate of 100 Kg N fed^{-1} as recommended dose at two equal doses and slow-release fertilizer (sulfur coated) added by rate of 50 $kg.fed^{-1}$ sulfur coated. The recommended dose of phosphorus and potassium fertilizers were applied as superphosphate (6.7% P_2O_5) and potassium sulphate (39.7% K_2O) at the rates of 200 Kg P_2O_5 fed^{-1} and 50 Kg K_2O fed^{-1}, respectively.

2. 6 Foliar Application of Micronutrients (Manni plex beans)

Manni plex beans play an important role in the flowering process through the success of the process of germination of pollen and the growth tube vaccine and thus the success of the holding flowering and fertilization and install it. Manni plex beans contains Zn 2.5%,Mn 3.5% , Fe 0.36% B 0.24% and add to soil at rate 2-4 L/ feddan.

2. 7 Experimental design and data analysis

The experimental design was complete block design with 4 replicates and 9 treatments (36 plots), each plot 1.4m x1.2m= 1.68m^2 cultivated with 32 plants. Main plots were (Control, NPK 100 %, NPK 75 %, NPK 100 %+ Compost , NPK 75 % + Compost, NPK 100 % Manni plex beans, NPK 75 % + Manni plex beans, NPK 100 %+ compost + Manni plex beans, NPK 75 %+ compost + Manni plex beans).

All data were Statistically analysis according to [18] using CO-STAT-C computer software package. The least significant difference (L.S.D) at (0.05) level of probability was used compare

the treatments values.

3. Results and Discussion

3. 1 Effect of compost, mineral fertilizers and Manni plex beans on N, P, K %, Fe, Mn and Zn mg/kg D.W in leaves of beans plant.

Data in table (3) revealed that at treatments under study superior and significant increased on control which gave higher values compared to control for NPK contents in leaves. In this respect, the treatment of NPK 100% +compost + Manni plex beans achieved the highest values, nutrient contents (NPK) were recorded 4.11 % , 0.465 %, and 3.12 % respectively in leaves of beans, while the control gave the lowest values, recorded 3.39 % 0.379 and % 2.37 % of NPK respectively. These results are in harmony with those found by [19] ,who reported that increased leaves contents of N and K of snap beans plants by adding (100 kg N ha^{-1}) may be due to improve the soil physical and chemical properties by presence of higher levels of nutrient released of organic matter, as well as[20] reported that application of combinations between compost manure and mineral nitrogen fertilizer increased NPK content in leaves of pea plant.

Data in table (3) showed that all test treatment significant improved micronutrients (Fe, Mn and Zn) mg/100g dry weight (D.W) in leaves of beans plant. Over the control plant decreased micronutrients content in leaves which recorded the lowest values 227.4 ,34.8 and 81.8 mg/kg dry weight, respectively in leaves of beans plant. On the other hand, the interaction between NPK100%+compost+ Manni plex beans, treatments resulted the highest values of Fe, Mn and Zn (262.7 ,61.5 and 109.2 mg/kg) D.W in leaves.. These results agreement with the findings of [21] who referred that "Fe, Zn and Mn contents increased significantly with the foliar spray of Manni-Plex and amino acids treatments with the highest effect recorded with the highest Manni- Plex concentration". [12].reported that foliar application of Zn or B led to positive increases of macronutrients (N, K and Ca) and micronutrients (Zn, B and Cu) concentration in bean leaves,. Similarly [22] found that micronutrients, particularly Zn, Fe and Mn applied by foliar spraying were significantly increased the vegetative growth and content of micronutrients on leave plant.

Table 3. Effect of compost ,mineral fertilizers and Manni plex beans on N%, P%, K % , Fe,, Mn and Zn mg/kg D.W in leaves

Treatments	Leaves					
	N %	P %	K %	Fe mg/kg D.W	Mn mg/kg D.W	Zn mg/kg D.W
Control	3.39	0.379	2.37	227.4	34.8	81.8
NPK 100%	3.49	0.396	2.53	237.1	41.2	88.8
NPK 75%	3.44	0.391	2.43	231.9	37.8	85.1
NPK 100%+ compost	3.75	0.417	2.70	247.7	48.3	96.3
NPK 75% + compost	3.66	0.407	2.60	241.8	44.2	92.9
NPK 100%+ Manni plex beans	3.92	0.440	2.91	257.9	56.0	102.5
NPK 75 %+ Manni plex beans	3.84	0.430	2.80	252.9	51.9	99.8
NPK100%+compost+ Manni plex beans	4.11	0.465	3.12	262.7	61.5	109.2
NPK75 %+compost+ Manni plex beans	4.01	0.453	3.00	258.9	59.0	106.2
F test	**	**	**	**	**	**
LSD at 5%	0.08	0.006	0.06	10.4	0.8	0.8

3. 2Effect of compost, mineral fertilizers and Manni plex beans on N, P, K%, Fe, Mn and Zn mg/kg D.W in stem of beans plant.

Data tabulated in table (4) presented that under effect of treatment mineral fertilizers, Manni plex beans and compost, the control achieved the lowest values on macronutrients (NPK) in steam of beans compared other treatments, followed by NPK75 %+compost+ Manni plex beans tretment. While treatment NPK100%+compost+ Manni plex beans was the superior one in this respect, recorded 1.10 % ,0.132 % and 0.97 % of NPK. these results agreement with [23] who stated that compost treatments enhanced growth and increased N, P, K in leaves and stem of Snap Beans. Also [24] reported that addition organic and inorganic to beans plant enhanced properties of plant and content P in all plant (stem , leaves and roots). The increased potassium in stem of beans may be due to compost stimulate plant growth and increased macro and micro nutrients adsorption and improved content NPK in plant [25].

Data in table (4) showed that all treatments significant increased studied micronutrients over control in stem of beans plant .The control decreased Fe, Mn and Zn on roots which presented 44, 6.9 and 16.3 mg/kg D.W .Whereas the treatment of NPK100 % + compost+ Manni plex beans

gave the highest values 53.3, 12.7and 24 mg/kg D.W respectively in stem of beans plant. These results are in approval with [26]who found that the application of different Fe sources increased beans Fe concentration [27] noted that applied high zinc concentration in pea plant increased Zn in stem [28] mentioned that under foliar application of organic-chelate fertilizers ,plant tissue concentrations of macro-and micronutrients including N,P ,Mg, Fe, Mn, Zn and some other nutrients are expected to increase.

Table 4. Effect of compost ,mineral fertilizers and Manni plex beans on N, P K %, Fe,, Mn and Zn mg/kg D.W in stem

Treatments	Stem					
	N %	P %	K %	Fe mg/kg D.W	Mn mg/kg D.W	Zn mg/kg D.W
Control	0.49	0.069	0.36	44.0	6.9	16.3
NPK 100%	0.65	0.091	0.52	46.1	8.3	18.3
NPK 75%	0.56	0.082	0.46	45.1	7.7	15.1
NPK 100%+ compost	0.80	0.104	0.69	48.6	9.9	19.8
NPK 75% + compost	0.73	0.099	0.62	47.1	9.0	18.6
NPK 100%+ Manni plex beans	0.96	0.123	0.84	51.0	10.9	23.0
NPK 75 %+ Manni plex beans	0.89	0.115	0.77	49.5	10.4	20.8
NPK100%+compost+ Manni plex beans	1.10	0.132	0.97	53.3	12.7	24.0
NPK75 %+compost+ Manni plex beans	1.04	0.127	0.93	52.2	11.9	22.4
F test	**	**	**	**	**	**
LSD at 5%	0.07	0.006	0.05	0.9	0.5	0.7

3. 3 Effect of compost, mineral fertilizers and Manni plex beans on N, P, K%, Fe, Mn and Zn mg/kg D.W in roots of beans plant.

Concerning the effect of different treatments on NPK on roots of beans plant in table (5) showed that control significant decreased on NPK in roots. Nitrogen ,phosphorus and potassium were reported 1.51%, 0.134 % and 0.60 % and the highest values of NPK content in roots of beans was with the treatments NPK100 % +compost + Manni plex beans were recorded 1.96 % 0.252 and 1.19 % in season, followed in order by NPK75 %+compost+ Manni plex beans and NPK100%+ Manni plex beans. These results are in line with[29]who found that organic matter with nitrogen fertilizer increased roots dry weight and macronutrients in roots of legume spices. [30] mentioned that applied phosphorus fertilizer on soybeans increased uptake P on roots compared control

plant.[31] Studied applied chemical fertilizers NPK and micronutrients Fe ,Zn and Mn on pea plant, and found that NPK content in roots may be due to the effect of fertilizers.

Data presented in table (5) showed that all treatments significantly increased Fe, Mn and Zn contents on roots compared with the control, then the treatment of NPK 75%. On the other hand, the combination of NPK100%+compost+ Manni plex beans treatment resulted the highest value of micronutrients (Fe, Mn and Zn) contents on roots of bean plant. It was recorded 132.4, 29.8, 53.9 mg/kg. D.W respectively. These results agree with results of [10]who stated that as a result of micronutrients foliar applications ,the characters of root and shoot significantly affected . [32] Found that Fe increased in root nodulation and soil under effect compost on beans plant compared to control. [33] Reported that applied nitrogen fertilizers with organic matter improved content Mn and Zn and other elements in roots and all organs of vicia faba plant.

Table 5. Effect of compost ,mineral fertilizers and Manni plex beans on N, P ,K % Fe,, Mn and Zn mg/kg D.W in roots

Treatment	Roots					
	N %	P %	K %	Fe mg/kg D.W	Mn mg/kg D.W	Zn mg/kg D.W
Control	1.51	0.134	0.60	114.0	17.3	39.8
NPK 100%	1.64	0.144	0.77	118.7	20.9	43.3
NPK 75%	1.58	0.142	0.66	116.3	18.9	41.4
NPK 100%+ compost	1.77	0.160	0.93	122.7	23.5	46.9
NPK 75% + compost	1.70	0.154	0.80	120.3	22.6	45.1
NPK 100%+ Manni plex beans	1.86	0.179	1.07	128.0	27.1	50.2
NPK 75 %+ Manni plex beans	1.79	0.174	0.96	124.9	24.3	48.6
NPK100%+compost+ Manni plex beans	1.96	0.252	1.19	132.4	29.8	53.9
NPK75 %+compost+ Manni plex beans	1.87	0.187	1.14	129.9	28.5	51.17
F test	**	**	**	**	**	**
LSD $_{\text{at 5\%}}$	0.06	0.553	0.04	0.9	3.4	0.7

3. 4 Effect of compost, mineral fertilizers and Manni plex beans on N, P, K%, Total Carbohydrate %, Crude Protein content% and Vitamin C.mg/100g on seeds of beans plant.

Data presented in table (6) showed that all treatments significant increased NPK content in seeds. The highest values of nitrogen content on seeds was with the treatments NPK100%+compost+ Manni plex beans which recorded (3.88%) ,the same results found with Phosphorus (0.420 %) and potassium (3.01 %). While the control and the mineral fertilizer with rate of 75% resulted the lowest value. These results are in approval with [34] who reported that combination between organic matter fertilizer and chemical fertilizers increased potassium content on seeds of beans plant. Also, [10] found that the mixed foliar treatment (Fe+Zn+B) were higher 13.3% for seeds/pod to 25.7% for seed yield/plant.

Table 6. Effect of compost, mineral fertilizers and Manni plex beans on N, P, K %, Total Carbohydrate % ,Crude Protein content% and Vitamin C .mg/100g in seeds

Treatments.	Seeds					
	N%	P%	K%	Total Carbohydrate %	C. Protein content	Vitamin C mg/100g
Control	2.81	0.344	2.05	38.31	17.65	19.34
NPK 100%	3.13	0.362	2.30	41.62	19.54	21.95
NPK 75%	2.99	0.351	2.16	39.87	18.69	20.74
NPK 100%+ compost	3.35	0.378	2.55	44.79	20.92	24.50
NPK 75% + compost	3.25	0.373	2.39	45.02	20.33	23.27
NPK 100%+ Manni plex beans	3.58	0.403	2.82	47.62	22.44	27.43
NPK 75 %+ Manni plex beans	3.50	0.394	2.65	47.97	21.86	25.87
NPK100%+compost+ Manni plex beans	3.88	0.420	3.01	50.60	24.23	38.34
NPK75 %+compost+ Manni plex beans	3.74	0.409	2.65	49.73	23.35	30.05
F test	**	**	**	**	**	**
LSD at 5%	0.09	0.006	2.91	2.35	0.54	0.59

Micronutrients play a key role on seeds components. Data in table (6) showed that all studied treatments significant increased, particularly with the interaction of NPK100%+compost+ Manni plex beans treatments.[35] Examined the effect of used micronutrients on yield components of

bean (*Phaseolus vulgaris*) and they found that grain yield had significant correlation to Zn and Cu of leaves. Results in table (6) showed that treatments had positive effect on V. C mg/ 100g on seeds and the highest values in experiment was NPK100% +compost + Manni plex beans it recorded 38.34 mg/ 100g. While control was recorded the lowest values 19.34. The results are agreed with those obtained by .[36] found that applied Zn on beans plant increased content of vitamin of seed.

4. Conclusion

Bean (*Phaseolus vulgaris L.*) is a present regarded as one of the most important vegetables grown in Egypt. A field experimental was carry out in the season of 2015 using nine treatments of organic (compost) , mineral fertilizer and foliar application of micronutrients with their interaction to study the effect of studied treatments on some of macro and micronutrients concentrations of Bean (*Phaseolus vulgaris L.*) as well as seed components. It can be concluded that the use of manni-plex as foliar application of micronutrients with compost and NPK fertilizer led to an increase in concentrations of macro and micronutrients in both vegetative growth and components of grain, this effect may be attributed mainly to the vital physiological roles in plant cells which promote the concentrations of plant nutrients.

5. References

[1] Zeid, H. A., Wafaa, H. M., Abou El Seoud, I. I., & Alhadad, W. A. A. (2015). Effect of organic materials and inorganic fertilizers on the growth, mineral composition and soil fertility of radish plants (Raphine's sativus) grown in sandy soil. Middle East *Journal of Agriculture Research*, 4(01), 77-87.

[2] FAO. (2010) Food and Agriculture Organization of the United Nations. Faostat: Statistical Database,

[3] Ussiri, D. A. N. and R. Lal. 2005. Carbon Sequestration in Reclaimed Minesoils. Critical Reviews in Plant Sciences, 24, 151–165.

[4] Abou-El-Hassan, S., Abd Elwanis, M., & El-Shinawy, M. Z. (2017). Application of compost and vermicompost as substitutes for mineral fertilizers to produce green beans. Egyptian *Journal of Horticulture*, 44(2), 155-163.

[5] Gracia-Gil, J. C.; Cippe, C. P.; Polo, M. I and A. Sensi.(2004) long term effects of amedament with municipal solid waste compost on the elemental and acidic functional group composition and PH buffer capacity of soil humic acid . Geoderma, 121(1-2): p.135-142.

[6] Melero, S.; Madejon, E.; Ruiz, J. C and Herencia, J. F. (2007). Chemical and biochemical properties of a clay soil and Alkaline Soils. USDA Handbook 60. US Govern-ment Printing Office, Washington D.C.

[7] El-Habbasha, S. F., Hozayn, M., & Khalafallah, M. A. (2007). Integration effect between phosphorus levels and biofertilizers on quality and quantity yield of faba bean (Vicia faba L.) in newly cultivated sandy soils. *Research Journal of agriculture and biological sciences*, 3(6), 966-971.

[8] Ahmed,H.;Nesiem,M.R.L.;Hewedy,A.M and Sallam,H.S. (2010) Effect of some simulative compound on rowth ,yield and chemical composition of snap bean growth under calcareous soil condition .*J .Am.Sci* . 6(10): 525-554.

[9] Brown, G.,' Newman, A .C .D . Rayner, I. H and Weir, A. H. I978. The structures and chemistry of soil clay minerals. Pages 29-178 in D. Greenland and M.H.B. Hayes, eds. The chemistry of soil constituents. John Wiley and Sons, New York, New York.

[10] Kalra, Y. P and D. G. Maynard. (1991). Methods manual for forest soil and plant analysis. For. Can., Northwest Reg, North. For. 'Cent, Edmonton, Alberta. lnf. Rep. NOR-X-319.

[11] Salem, A. K., El-Harty, E. H., Ammar, M. H., & Alghamdi, S. S. (2014). Evaluation of faba bean (Vicia faba L.) performance under various micronutrients foliar applications and plant spacing. *Life Sci. J*, *11*(10), 1298-1304.

[12] Hamouda H.A., T.G. Anany and M.S.S. El-Bassyouni (2018). Growth and Yield of Dry Bean (*Phaseolus vulgaris* L.) as Affected by Zn and B Foliar Application. *Middle East Journal of Agriculture Research*, 7(02), 639-649.

[13] Jackson, M. L.(1967). Soil Chemical Analysis. Printic Hall Englewood Cliffs,New Jersy.

[14] Hesse, P.R.(1971). A text book of soil chemical analysis. John Murray Publisher, London, Pages: 324.

[15] Chapman, H. D. and P. F. pratt (1961). "Methods of Analysis for Soils, Plants and Waters". DIV. of Agric. Sci., California Univ., Berkely, USA.

[16] Ranganna, S. (2001). Handbook of analysis and quality control for fruit and vegetable products. Tata McGraw-Hill publishing Co. Ltd, New Delh.

[17] A. O. A. C. (1990): Official Methods of Analysis Association of Official Analytical Chemists. 15th Ed. Inc. Wash. D.C.

[18] Gomez, K. A. and A. A. Gomez (1984): Statistical Procedures for Agricultural Research 2nd Ed, John Wiley and Sons. Inc. New York. .

[19] Amanullah, M.M.; Somasundaram, E.; Vaiyapuri, K and Sathyamoorthi, K. (2007) Poultry manure to crops -A Review. *Agric. Rev*., 28: 216–222

[20] Moghazy, A. M.; El. Saed, S. M and Awad E. S. M. (2014). The Influence of Boron Foliar Spraying with Compost and Mineral Fertilizers on Growth, Green pods and Seed Yield of Pea. Nature and science .,12(7):50-57.

[21] Abdel-Mawgoud, A. M. R., El-Bassiouny, A. M., Ghoname, A., & Abou-Hussein, S. D. (2011). Foliar application of amino acids and micronutrients enhance performance of green bean crop under newly reclaimed land conditions. *Aust. J. Basic Appl. Sci*, *5*(6), 51-55.

[22] Sarkar, D.; Mandal, B and Kundu, M.C. (2007). Increasing] use efficiency of boron fertilizers by rescheduling the time and methods of application for crops in India., Plant Soil, 301:77-85.

[23] Abou El-Yazied, A.; El-Gizawy,A.M.;Ragab, M.I and Hamed, E.S. (2012). Effect of seaweed Extract and compost treatment on growth yield and quality of nap bean., J.Am.Sci., 8(6):1-20.

[24] Luqueno, F.F.; Varela, R.; Surez, C.M.; Menses,Y and Dendooven.R.C. (2010). Effect of different nitrogen sources on plant characteristics and yield of common bean (Phaseolus vulgaris L.). Bioresource Technology 101 : 396–403.

[25] Atiyeh, R.M.; Dominguez, J.; Sobler, S and Edwards, C.A. (2002). Changes in biochemical properties of cow manure during processing by earthworms (Eisenia andrei) and the effects on seedling growth; Pedobiologia., 44: 709-724.

[26] Erdal, U. (2004). Effect of Foliar Iron Applications at Different Growth Stages on Iron and Some Nutrient Concentrations in Strawberry Cultivars., *Turk J Agric For*. 28: 421-427.

[27] Stoyanova, Z and Doncheva, S (2002). The effect of zinc supply and succinate treatment on plant growth and mineral uptake in pea plant. *Braz. J. Plant Physiol*.14 (2): 240-255.

[28] Aslani, M., and Souri, M. K. (2018). Growth and quality of green bean (Phaseolus vulgaris L.) under foliar application of organic-chelate fertilizers. *Open Agriculture*, *3*(1), 146-154.

[29] Otieno,P.; muthomi,J,W.; .Chemining,G.N.; Nderitu.J.H .(2007). Effect of rhizobia inoculation, farmyard manure and nitrogen fertlizers on growth, nodulation and yield of selected food grain legumes. Afri.crop, scie. conf, procee .,8 -305-312.

[30] Darwesh,D.A.;Maulood,P.M.;Amin.S.A. (2013). Effect of phosphorus fertilizers on growth and physiological phosphorus use efficiency of three soy bean cultivars. *Journal of Agriculture and Veterinary Science*.,3 (4): 32-36.

[31] Zaghloul, R. A., Abou-Aly, H. E., El-Meihy, R. M., & El-Saadony, M. T. (2015). Improvement of growth and yield of pea plants using integrated fertilization management. *Universal J. Agric. Res*, *3*(4), 135-143.

[32] Hong, L. (2015) Co-limitation of Soil Iron in Root Nodulation and Chlorophyll-Bean Formation of Yard long Bean Plants in Tropical Humid Environment. International Journal of Bioscience, Biochemistry and Bioinformatics. 5(4): 232-240.

[33] Yolcu,H. (2011). the effects of some organic and chemical fertilizer applications on yield, morphology, quality and mineral content of common vetch (vicia sativa l.). Turkish Journal of Field Crops., 16(2): 197-202.

[34] Uyanoz, R. (2007) The Effects of Different Bio-organic, Chemical Fertilizers and their Combination on Yield,Macro and Micro Nutrition Content of Dry Bean (Phaseolus vulgaris L.).*International Journal of Agricultural Research*, 2: 115-125.

[35] Poshtmasari, H. K and Bahmanyar, M.A (2008) Effect of Zn rates and application forms on protein and some micronutrients accumulation in common bean (Phaseolus vulgaris) . *Pakistan Journal of Bioloical Science* 11(7):1042-1046.

[36] El-Tohamy, W.A and El-Greadly, N.H.M. (2007). Physiological Responses, Growth, Yield and Quality of Snap Beans in Response to Foliar Application of Yeast, Vitamin E and Zinc under Sandy Soil Conditions. Australian Journal of Basic and Applied Sciences., 1(3): 294-299.