

Enhancement of growth and yield of faba bean plants grown under sandy soil conditions by foliar spraying of different doses of yeast extract and humic acid

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ABSTRACT

Foliar spraying is one of the critical operations in agricultural practices. In this concern two field experiments were fulfilled during two seasons of 2016/2017 and 2017/2018 under sandy soil at EL-Nubaria region. The goal of this test is to discuss the vegetative growth, total yield, and chemical characteristics of broad bean plant (*Vicia faba* L.) cv. Spanish as influenced by foliar spraying of doses yeast extract and humic acid it was posture at once or on double doses and without yeast extract and humic acid and interaction effect on plant growth, yield, and chemical seeds characteristics. The results of plant growth parameters like plant length, number of leaves/plant, fresh weight of leaves and whole plant and the elevated total seeds yield as well as the rising content of the percentage of N, P, K and protein of broad bean seeds tissues were detected with that plants which sprayed as double doses of humic acid (4 cm/L) and double doses of yeast extract (6 ml/L) compared to one doses and without spraying.

Keywords: Broad bean, yeast extract, humic acid- one or double doses.

Introduction

Broad bean (*Vicia faba* L.) is one of the most substantial winter legume crops and a great protein source for jointly human and animal feeding (Crepon *et al.*, 2010). Ripe seeds of broad bean are perfect exporter of protein (around 25% in dried seeds), starch, cellulose, vitamin C, and minerals (Hacısefero *et al.*, 2003). At the same time, its cultivation leads to an increase of soil N synthesis (Hungria and Vargas, 2000).

Many studies specific that yeast is one of the wealthy source of rise quality protein, namely the major amino acids like lysine, tryptophan etc., contain the essential minerals and trace elements, namely calcium, cobalt, iron etc. and the better sources of the B-complex vitamins like B1, B2, B6 and B12. The extractor is an invaluable exporter of bio-ingredient especially cytokinins (Amer, 2004) that function as a facily available growth complement for plants that finally increased plant product (Ghoname *et al.*, 2009). However, it is a source of cytokinins and protein that promote cell division and magnification (Barnett *et al.*, 1990). Moreover, Yeo *et al.*, (2000) reported that yeast extracts restrain trehalose-6-phosphate syntheses which had a key enzyme for treadles bio synthesis. Also Mahmoud, *et al* (2013) stated that, yeast extracts increased all the pea vegetative growth characteristics, green pods yield and pod quality were recorded with fertilizer the highest concentration of yeast extracts (2%). Moreover, El-Desuki and El-Gereadly (2006) recorded that, vegetative growth of pea plant, leaves satisfaction of photosynthesis pigments, free amino acids, carbohydrates and cytokinins, pod yield and quality as well as nutritive value were improved by increasing the levels of yeast extract in spraying solution from 1% up to 3%. The increasing of growth, flowering, total yield and pods quality of some plants by utilize foliar spraying with yeast extract was found by Abou EL-Yazied and Mady (2011 and 2012) and Mahmoud *et al.* (2013). In the same respect, Neama *et al.* (2014) revealed that the highest values of plant growth standard such as plant length, number of leaves and branches as well as fresh and dry weight of leaves, branches and whole plant and the highest rate of total pods yield and various member and the content of nitrogen and protein % in seeds tissues were reported when sprayed by high application of yeast extract (6 ml/L).

The humic substance is formed during the chemical and biological humification of plant and animal case by the biological performance of microorganisms. These substances improve plant growth

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directly and indirectly. The indirect belongings on soil fertility contain: (i) the improve in the soil microbial inhabitation included advantageous microorganisms, (ii) increased the soil framework, and (iii) the improved in the cation exchange capacity and the pH cultivate capability of the soil. Related direct effects, humic synthesis may have different biochemical effects every at cell dike or in the cytoplasm, inclusive improved photosynthesis, respiration levels, enzymatic efficiency, protein structure (Nardi *et al.*, 2002), and plant hormone this efficiency (Chen and Aviad, 1990).

Humic acid is a substantial component of humic substances that include many practical groups located at the carbon series. They could be acidic (e.g., carboxylic acid and phenol), alkaline (e.g., amine, imines), or neutral collection (e.g., alcohol, aldehyde, ketone, ether, ester, and amide) which increased plant growth (Kadam and Wadje, 2011). Humic acid increased physical (Varanini *et al.*, 1995), chemical, and biological property of soils (Mikkelsen, 2005), dominant soil-borne diseases and increasing soil health and nutrient uptake by plants, mineral availability, fruit quality (Mauromicale *et al.*, 2011). Moreover, humic acid catalyze plant enzymes/hormones and increase soil fertility in an ecologically and environmentally decent style (Mart, 2007). The hormone such efficacy of humic acid in special auxin, cytokinin, and gibberellins are fully authenticated in various papers (Chen *et al.*, 2004). When humic acid was used to sandy soils, it take in fundamental organic material substantial for water attachment, thus increasing the root growth and promote the sandy soil ability to keep and not leach out pivotal plant nutrients (Khaled and Fawy, 2011). Foliar sprays of these substances also elevate growth and improved yield and quality in a number of plant species (Yildirim, 2007). The commercial humic acids increased growth, yield production, quality and significant increase in the collection of P, K, Ca, Mg, Fe, Zn and Mn in tissues of plants as well as improved collection of N and Ca in roots Erik *et al* (2000). In the same respect, Abdel-Razzak and El-Sharkawy (2013) found that excellent effect for improving vegetables output by sprayed with humic acid for two times. In the same times, Shehata *et al.* (2012) found that the highest register plant growth, total yield and nutrients values of cucumber plants were reported with 1.5 g/L humic acid compared with control. However. Shafeek *et al.* (2013) reported that foliar spraying of height levels of humic acid (4g/L) recorded the high values of growth characteristics i.e. number of leaves and branches, fresh weight of whole plant and its different accessories as well as total yield and its strain (pod length and number of pod/plant). Also grant the elevated percentage of protein and nitrogen contents as well as Fe (mg/g dry weight) in broad bean seeds tissues. Moreover, Dawood *et al.*(2019) found that humic acid at 5% had a favorable effect on growth characteristics, photosynthetic pigments, seed yield, and yield ingredient as well as some biochemical constituents of the yielded broad bean seeds (total carbohydrate, total phenolic content, proline, and free amino acids).

Thus, the impartial of this study examine the growth, yield and its components of broad bean plants as affected by spraying of various doses of high levels of yeast extract and humic acid fertilizer under sandy soil conditions.

Material and Methods

Two field experiments were carried out at the Agricultural Production and Research Station, National Research Centre, El Nubaria Province, El Behira Governorate, Egypt, during the two successive winter seasons of 2016/2017 and 2017/2018, to study the response of broad bean plants to foliar spraying with humic acid (4 g/L as potassium humate) it was position at once or on two batches and without humic acid with yeast extract at (6 ml/L), it was position at once or on two batches, without yeast extract and interaction effect on growth, yield and yield components as well as some chemical constituents.

However, humic acid is a commercial product containing macronutrients such as N (5.0 g/L), P (0.5 g/L), K (15.0 g/L), Folic acid (0.5 g/L), Humic acid (23.0 g/L) and Density(1.4 g/cm³). Physical and chemical characteristics of soil (0-30 depth) in the experimental site were as follows: sand 91.2%, silt 3.7%, clay 5.1%, PH 7.3, organic matter 0.3 %, CaCO₃, 1.4%, EC 0.3 ds/m, soluble N 8.1 ppm and available P 3.2 ppm, soil measured as described by Chapman and Pratt (1978). The experimental unit area was 10.5 m² consisting of fifteen rows (3.5 m long and 20 cm between rows), 20 cm between hills.

The experimental design was split- plots design with three replicates, yeast extract doses was assigned in the main plots and humic acid doses was randomly distributed in the sub-plots.

Yeast extract and Humic acid spraying was conducted two times; first one was after 20 days of planting date and then every 15 days for the second spray. Spraying was applied in early morning. Nitrogen fertilizer at the rate of 30 kg N/fed was added as ammonium sulfate (20.6 % N) in three equal doses after 15, 30 and 45 days after sowing. Phosphorus fertilizer, as calcium superphosphate (15.5% P₂O₅) at the rate of 15 kg P₂O₅/fed and potassium sulfate (48 % K₂O) at the rate of 24 kg K₂O/ fed were applied during seed bed preparation. Organic fertilizer was added at the rate of 20 m³/fed. Broad bean seeds variety Spanish were sown on first week of December in the two seasons after inoculated with Rhizobium strain and irrigated just after sowing using drip irrigation system.

The normal agronomic practices of growing broad bean were practiced till harvest as recommended by Legumes Research Dept., A.R.C., Giza. Yeast extract was prepared from brewer's yeast (*saccharomyces cerevisiae*), dissolved in water followed by adding sugar at a ratio of 1: 1 and kept 24 hours in a warm place for reproduction according to the methods of Morsi *et al.* (2008). Chemical analysis of activated yeast is shown in table (1).

Table 1: Chemical analysis of activated yeast (mg/ 100g dry weight).

Minerals		Amino acids		Vitamins	
Total N	7.23	Arginine	1.99	Thiamin	2.71
P ₂ O ₅	51.68	Histidine	2.63	Riboflavin	4.96
K ₂ O	34.39	Isoleucine	2.31	Nicotinic acid	39.88
MgO	5.76	Leucine	3.09	Pantothenic	19.56
CaO	3.05	Lysine	2.95	Biotin	0.09
SiO ₂	1.55	Methionine	0.72	Pyridoxine	2.90
SO ₂	0.49	Phrynalanine	2.01	Folic acid	4.36
NaCl	0.30	Theronine	2.09	Cobalamin	153ug
Fe	0.92	Tryptophan	0.45	Enzymes	
Ba	157.6	Valine	2.19	Oxidase	0.350
Co	67.8	Glutamic	2.00	Peroxidase	0.290
Pd	438.6	Serine	1.59	Catalase	0.063
Mn	81.3	Aspartic acid	1.33		
Sn	223.9	Praline	1.53	Carbohydrates	23.20
Zn	335.6	Tyrosine	1.49		

1. Growth characteristics:

A random sample of ten plants from each plot was taken at 90 days after sowing to the laboratory where the following characteristics were recorded, plant height (cm), number of leaves per plant and fresh weight of leaves and whole plant as g/plant.

2. Yield and yield components:

A random sample of 20 pods were taken from each experimental plot were recorded, number of pods/plant, number of seeds\ pod, average pod weight (g) and total yield of (seed) was weighed and expressed as values per feddan as (ton/fed.).

3. Chemical analysis of seeds:

N % in dry seed was determined according to the method of Pregl (1945). However, P and k % in dry seeds were determined according to the methods of Troug and Mayers (1939) and Brown and Lilleland (1964) respectively. The percentage of crude protein was determined according to A.O.A.C. (1975).

The obtained data were subjected to the analysis of variance procedure and treatment means were compared to the LSD test according to Gomez and Gomez (1984).

Results and Discussion

1. Growth characteristics:

1.1. Effect of yeast extract doses:

Concerning foliar spraying of yeast extract, data in Table (2) shows that, foliar application of yeast extract by double doses of high level (6 ml/L) was the utmost convenient for improving plant growth,

expressed as (plant length (cm), fresh weight (g) of leaves and whole plant) in both two seasons as parallel with the other calculated foliar application of yeast extract treatments. The statistical test of the gained data found that the divergence within various doses of foliar application of yeast extract were range the 5% level of significance excepting number of leaves plant in both seasons. These returns are in endorsement with the results of Abou EL-Yazied and Mady (2012) and Neama *et al.* (2014) on broad bean plants and Mahmoud, *et al* (2013) on pea plants who reported that spraying of high level of yeast extract improved plant growth. The notability of plants growth in restraint to the foliar spray of yeast extract may be attributed to its contents of various nutrients, i.e. (P, K, Mg, Ca, Fe, Ba, Mn and Zn), higher proportion of proteins, higher account of free amino acid and vitamins (Table 1) which may play an substantial role in increasing growth and dominant the happening of fungi diseases (Bevilacqua *et al.*, 2008).

Table 2: Effect of yeast and humic acid doses on growth characteristics of broad bean plant during 2016- 2017 and 2017-2018 seasons.

Yeast doses	Humic acid doses	2016-2017 season				2017-2018 season			
		Plant length (cm)	N. of leaves\plant	Fresh weight (g)		Plant length (cm)	N. of leaves\plant	Fresh weight (g)	
				leaves	plant			leaves	plant
Without	Without	67.33	41.00	71.67	176.30	64.00	37.00	68.00	169.00
	One dose	77.33	42.33	77.33	182.30	74.67	38.33	74.00	176.67
	Two doses	80.67	49.67	81.67	190.0	77.33	46.00	78.00	183.33
	Mean	75.11	44.22	76.89	182.89	72.00	42.44	73.33	185.20
One dose	without	73.33	42.67	77.67	192.67	70.00	39.33	74.33	186.67
	One dose	81.67	52.67	82.00	203.33	78.00	49.33	78.33	195.33
	Two doses	88.33	54.33	89.33	210.00	85.00	51.00	86.00	206.33
	Mean	81.10	49.99	83.00	202.00	77.67	46.56	79.56	195.10
Two doses	without	82.00	51.00	81.33	203.33	78.33	46.67	78.00	200.00
	One dose	90.00	57.00	88.67	223.33	86.67	53.33	85.00	213.33
	Two doses	96.00	62.00	88.00	240.30	92.67	58.67	84.33	233.67
	Mean	89.20	56.67	86.00	222.33	85.89	52.99	82.44	207.80
Average Humic acid	without	74.22	44.89	76.89	190.78	70.78	41.00	73.44	185.22
	One dose	83.00	50.67	82.67	203.00	79.78	47.00	79.11	195.11
	Two doses	88.33	55.33	86.33	213.4	85.00	51.89	82.78	207.78
LSD at 5 % levels	Yeast	6.22	NS	3.47	7.68	6.27	NS	3.49	6.82
	Humic	5.96	2.91	3.72	6.69	5.99	2.98	3.72	7.20
	interaction	NS	NS	NS	NS	NS	NS	NS	NS

1.2. Effect of humic acid doses:

The foliar spray of humic acid at various doses i.e. 1 or 2doses had a statistical significant impact on the characteristics of broad bean plant growth in the two seasons of 2016/ 2017 and 2017/2018 Table (2) found that, the strength plants, i.e. plant length (cm) number of leaves, fresh weight of leaves and whole plant and its various parts all of them perform only with that broad bean plants which treat with humic acid by double doses these feedback are true in both seasons. In the same respect, humic acid by two doses significantly improved plant length, number of leaves and fresh weight of leaves and whole plant in the two seasons parallel the one dose. However, humic substances are especially utilized to drive out or decreased the negative effects of chemical fertilizers from the soil and have a considerable effect on plant growth as reported by many scientists (Ghabbour and Davies, 2001). Also, humic acid catalyze plant growth by the absorption of large and infant elements, enzyme activation and /orinhabitation, changes in film permeability, protein structure and eventually the activation of biomass output (Ulukan, 2008). These conclusion are in grade with gained with Yildirim, (2007), Unlu, *et al.* (2011), Shehata, *et al* (2012), Abdel-Razzak and El-Sharkawy (2013) and Shafeek *et al* (2013).

1.3. Effect of interaction between foliar spraying of yeast extract and humic acid:

Regarding with the interaction of both factors data in Table (2) specific that, vegetative growth of broad bean plants was not significant in both seasons. Generally, in resentment of the un-significant answer, but the acquired data found that the highest values of plant growth standard were reported when sprayed by double doses of highest level of yeast extract with double doses of highest concentration of humic acid as parallel to the other interaction treatments. These outcome held fully in both two experiential seasons.

2. Total yield and pods quality:

2.1. Effect of yeast extract doses:

As shown below in Table (3) foliar spraying with double doses of high levels of yeast extract at 6 ml/L improved number of pods / plant, number of seeds / pod and total seeds yield (ton/fed.) as well as green pod weight parallel with control ones. The statistical test of the gained data detect that number of pods / plant, number of seeds/ pod, pod weight (g) and total seeds yield per ton/fed.

Table 3: Effect of yeast and humic acid doses on total yield and yield characteristics of broad bean plant during 2016- 2017 and 2017-2018 seasons.

Yeast doses	Humic acid doses	2016-2017 season				2017-2018 season			
		Pod\ plant	Seeds\ pod	Pod weight (g)	Total yield (ton\ fed)	Pod\ plant	Seeds\ pod	Pod weight (g)	Total yield (ton\ fed)
Without	Without	5.00	4.50	74.67	0.79	4.67	4.00	72.67	0.75
	One dose	5.83	5.00	78.33	0.80	5.50	4.67	75.00	0.77
	Two dose	7.67	6.33	82.33	0.92	7.33	6.00	79.00	0.89
	Mean	6.17	5.28	78.44	0.84	5.83	4.89	75.56	0.80
One dose	Without	7.67	5.67	79.67	0.85	7.33	5.33	76.33	0.81
	One dose	9.33	6.33	86.33	0.86	9.00	6.00	83.00	0.83
	Two doses	11.33	7.00	91.67	0.92	10.67	6.67	88.33	0.89
	Mean	9.44	6.33	85.89	0.88	9.00	6.00	82.56	0.84
Two dose	Without	10.67	6.00	88.33	0.85	10.00	5.67	84.33	0.81
	One dose	12.33	8.00	95.00	0.98	12.00	7.67	91.33	0.95
	Two doses	12.67	9.00	103.33	0.99	12.33	8.67	100.00	0.96
	Mean	11.89	7.67	95.56	0.94	11.44	7.33	91.89	0.91
Average Humic acid	Without	7.78	5.39	80.89	0.83	7.33	5.00	77.78	0.80
	One dose	9.17	6.44	86.56	0.88	8.83	6.11	83.11	0.84
	Two doses	10.56	7.44	92.44	0.96	10.11	7.11	89.11	0.91
LSD at 5 % levels	Yeast	0.87	1.08	6.05	0.05	0.74	1.06	6.82	0.05
	Humic	0.58	0.73	3.50	0.04	0.71	0.74	3.39	0.04
	interaction	NS	NS	NS	NS	NS	NS	NS	NS

Significantly improved by double doses of yeast extract. This increase in total yield (ton/fed.) by foliar spraying of double doses of yeast extract was (11 % and 12%) for 1st and 2nd seasons respectively. when compared by control ones. However, double doses of high level of yeast extract significantly increased total seeds yield compared to the one dose and no treated (control). These feedback are in compact with the results by Mahmoud, *et al* (2013) on pea plants whom recorded that foliar spraying of high level of yeast extract improved total yields and their ingredient It could be concluded that, yeast extract treatments were propose to participate advantageous role through vegetative and reproductive growths through increasing flower formation and their set in all plants due to its high auxins and cytokinins contents and its useful effect on carbohydrate accumulation (Barnett *et al.*, 1990). The trend of this outcome is confirming by Abou EL-Yazied and Mady (2011 and 2012), Mahmoud, *et al.* (2013) and Neama *et al.* (2014) on broad bean plants.

2.2. Effect of humic acid doses:

The effect of foliar application with humic acid on total yield and its pod quality were given in (Table 3). Total yield in plots treat with double doses of foliar application of humic acid was significantly higher than those in plots foliar application of 0 or one dose in both seasons. Foliar application of double doses of high rates of humic acid (4g/L) reported the rising amount of total yield (0.96 and 0.91 ton/fed.) for 1st and 2nd seasons respectively. Compared (0.83 and 0.80 ton/fed) for 1st and 2nd seasons respectively by without humic acid (control). However, both doses of humic acid (one or two doses) significantly improved number of pods/plant, number of seeds/pod and pod weight (g) parallel to untreated plants. These effect held fully in both two experiential seasons. The influence of humic acid on broad bean pods could be impute to turnout of plant growth regulators, which are generated by improving activity of microbes expressed as fungi, bacteria, yeasts, actinomycetes and algae (Arancon *et al* 2004). It could be abstract that humic acid caused an increased in total seeds yield and caused as increase in some physical properties of pods if remedy at double doses of humic acid. These growing might be due to the function of humic acid in increasing heading enzyme activity and then improved the photosynthetic activity of plants and its yield (Delfine *etal.*, 2005). Humic acid might be give height to an augmentation in the structure of the chlorophyll and/or delayed chlorophyll retreating even under different stress as recorded by Meganid *et al.* (2015).

2.3. Effect of interaction between foliar spraying of yeast extract and humic acid:

The interaction impact of yeast extract at 0, one or two doses with the treatments of humic acid at 0, one or double doses are given in Table (3). The reported data found that the highest values of total seeds yield and different organs (number of pods/plant, number of seeds/pod and pod weight g) were acquired with broad bean plants which foliar application of yeast extract by double doses with humic acid by double doses. Statistical analysis of the acquired data was not great sufficient to reach the level of significant at 5%.

3. Chemical analysis of seeds:

3.1. Effect of yeast extract doses:

Foliar spraying of all doses of yeast extract performed in increment in broad bean seeds content of N, protein, P and K % (Tables 4). The data in this table reference that there was a statistically significant effect for the foliar application treatments compared to no treated (control). The highest values of all elements were registered by foliar spraying by double doses of yeast extract at a rate of 6ml/L. However, these results may be due to the content of macro and micro elements of the yeast extract. Table (1). In the same respect, El-Fouly (1983) summarized that, foliar spraying of microelements is highly recommended under Egyptian situation. In thought of the actuality the soil pH exceeds 7.5 and sometimes even 8.5 some areas and display high CaCO₃ contents which between other agents. make soil foliar application of micronutrients more expensive and impracticable. Also, the improving in broad bean yield and in the contents of micronutrients in seeds due to the foliar application of double doses of yeast extract correspond with the returns of Abou EL-Yazied and Mady (2011 and 2012), Mahmoud, *et al.* (2013) and Neama *et al.* (2014).

3.2. Effect of humic acid doses:

The data recorded in Table (4) found that the percentage of N, protein as well as P and K% of broad bean seeds tissues to the collect all doses of humic acid at high rates (4g/L) for experiential seasons through of 2017 and 2018. However, the plants which remedy with double doses of humic acid at high rates (4 g/L) performed in the highest percentages of nitrogen (5.06 and 4.62%) and protein(30.39 and 30.02%) contrast to the untreated treatment (control) reported nitrogen (3.66 and 3.33%) and protein (21.98 and 21.65%) in the two seasons respectively. In the same respect, all doses of foliar spraying of humic acid significantly increased the percentage of protein and nitrogen as well as P and K parallel to control treatment. Moreover, Srivastava (1995) stated that humic acid application increased photosynthetic rate, nutrient uptake from the soil to leaves, and translocation of these nutrients from the leaves to seeds, thereby enhancing seed yield without spending any energy as well as without any loss in transit. Humate treatment promote overall metabolism of crop plant sand total photosynthetic rate and hence the yield in overall (Zeng, 2002).

Table 4: Effect of yeast and humic acid doses on nutritional values of broad bean plant during 2016-2017 and 2017-2018 seasons.

Yeast doses	Humic acid doses	2016-2017 season				2017-2018 season			
		%				%			
		N	protein	P	K	N	protein	P	K
Without	without	3.16	18.94	0.72	3.66	2.82	18.61	0.69	3.63
	One dose	3.17	20.00	0.77	3.84	2.83	19.67	0.74	3.80
	Two dose	3.90	23.58	0.82	4.00	3.57	23.25	0.79	3.95
	Mean	3.41	20.84	0.77	3.83	3.07	20.51	0.74	3.79
One dose	Without	3.37	20.20	0.73	3.78	3.03	19.87	0.69	3.74
	One dose	4.17	25.00	0.79	4.33	3.83	24.67	0.76	4.26
	Two doses	5.03	30.20	0.85	4.88	4.70	29.87	0.82	4.63
	Mean	4.19	25.13	0.79	4.33	3.86	24.80	0.76	4.21
Two dose	Without	4.47	26.80	0.80	4.98	4.13	26.47	0.76	4.88
	One dose	5.73	34.40	0.90	5.85	5.20	33.87	0.87	5.70
	Two doses	6.23	37.40	0.95	5.96	5.60	36.93	0.91	5.62
	Mean	5.48	32.87	0.88	5.59	4.98	32.42	0.85	5.40
Average Humic acid	without	3.66	21.98	0.75	4.14	3.33	21.65	0.72	4.09
	One dose	4.36	26.47	0.82	4.67	3.96	26.07	0.79	4.59
	Two doses	5.06	30.39	0.87	4.95	4.62	30.02	0.84	4.73
LSD at 5 % levels	Yeast	0.48	2.44	0.02	0.20	0.54	2.44	0.01	0.36
	Humic	0.33	2.00	0.03	0.18	0.28	1.98	0.03	0.19
	interaction	NS	NS	NS	NS	NS	NS	NS	NS

3.3. Effect of interaction between foliar spraying of yeast extract and humic acid:

Table (4) reported that, the interaction effect between foliar spraying by various doses of yeast extract with foliar spraying of different doses of humic acid. It is unclouded that the interaction was not significant in its influence on the percentage of nitrogen, phosphorus, potassium and protein contents of broad bean pods tissues. Generally, the gained data steady that, the highest countervail of N, P, K and protein % were registered when foliar spraying on broad bean plants by all doses of yeast extract by high level of yeast extract (6 ml/L) with double doses of altitude levels of humic acid(4g/L) as compared other interaction treatments.

Conclusion

For producing the highest vegetative growth of faba bean plants grown in sandy soil and increasing the chemical contents, as well as maximizing the total seeds yield, it could be recommended to spay plants by double doses of humic acid (4 cm/L) and double doses of yeast extract (6 ml/L) as a foliar application.

References

- Abdel-Razzak, H.S. and G.A. El-Sharkawy, 2013. Effect of bio-fertilizer and humic acid applications on growth, yield, quality and storability of two garlic cultivars. *Asian J. of Crop Sci.*, 5(1): 48-74.
- Abou El-Yazied, A. and M.A. Mady, 2011. Effect of naphthalene acetic acid and yeast extract application on growth and productivity of tomato (*Lycopersicon esculentum* Mill.) plants. *Research Journal of Agriculture and Biological Sciences*, 7(2): 271-281.
- Abou EL-Yazied and M.A. Mady, 2012. Effect of boron and yeast extract foliar application on growth, pod setting and both green pod and seed yield of broad bean (*Vicia faba* L.). *Journal of Applied Sciences Research*, 8(2): 1240-1251.
- Amer, S.S.A., 2004. Growth, green pods yield and seeds yield of common bean (*Phaseolus vulgaris* L) as affected by active dry yeast, salicylic acid and their interaction. *J. Agric. Sci. Mansoura. Univ.*, 29(3): 1407-1422.

- AOAC, 1975. Official method of analysis Chemists. 12 th Ed. AOAC Washington, USA. Arancon, N.Q., C.A. Edwards, P. Baierman, C. Welch and J.D. Metzger, 2004. Influences of vermicomposts on field strawberries. *Bioresource Technol.*, 93(2): 145-153.
- Arancon, N.Q., C.A. Edwards, P. Baierman, C. Welch and J.D. Metzger, 2004. Influences of vermicomposts on field strawberries. *Bioresource Technol.*, 93(2): 145-153.
- Barnett, J.A., R.W. Payne and D. Yarrow, 1990. *Yeasts Characteristics and Identification*. Cambridge Univ. Press Publ. By the Press Syndicate of the Univ. of Cambridge Camb., pp: 999.
- Bevilacqua, A., M.R. Corbo, M. Mastromatteo and M. Sinigaglia, 2008. Combined effects of pH, yeast extract, carbohydrates and di-ammonium hydrogen citrate on the biomass production and acidifying ability of a probiotic *Lactobacillus plantarum* strain, isolated from table olives, in a batch system. *World J. Microbiol Biotechnol.*, 24: 1721-1729.
- Brown, J.D. and Lilleland, 1964. Rapid determination of potassium and sodium in plant material and soil extracts by flame photometry. *Proc. Amer. Soc. Hort. Sci.*, 48: 341-346.
- Champman, H.D. and P.F. Pratt, 1978. *Methods of analysis for soils, plants and Waters*, Univ. California, Div. Agric. Sci. Priced Pub. 4034.
- Chen, Y., M. De Nobili, and T. Aviad, 2004. Stimulatory effects of humic substances on plant growth. In: *Soil organic matter in sustainable agriculture* (Magdoff F., Weil R.R., eds). CRC Press, NY, USA. 103–129.
- Chen, Y. and T. Aviad, 1990. Effects of humic substance on plant growth. *Humic substances in soil and crop sciences: selected readings*. Soil Sci. Society of America. Madison. Wisconsin. 161-186.
- Crepon, K., P. Marget, C. Peyronnet, B. Carrouée, P. Arese, and G. Duc, 2010. Nutritional value of faba bean (*Vicia faba* L.) seeds for feed and food. *Field Crop Res.* 115:329–339.
- Dawood, M.G., R.A. Yasser, E.E. Mohamed and Gehan Shaker Bakhom, 2019. Enhancement quality and quantity of fababean plants grown under sandy soil conditions by nicotinamide and/or humic acid application. *Bulletin of the National Research Centre*, 43:28.
- Delfine, S., R. Tognetti, E. Desiderio, and A. Alvino, 2005. Effect of foliar application of Nand humic acids on growth and yield of durum wheat. *Agron Sustain Dev.*, 25:183–191.
- EL-Desuki, M. and Nadia, H.M. EL-Geready, 2006. Response of pea plants to foliar application of yeast extract. *J. Agric. Sci. Mansoura Univ.*, 31(10): 6667-6674.
- El-Fouly. M.M., 1983. Micronutrients in arid and semiarid areas: Levels in soil and plants for fertilizers, with particular reference to Egypt. *Proc. 17th codogium international potash Inst, Kakat and Marrakesh/ Morocco* 11.
- Erik, B., G. Feibert, C. Clint and L.D. Saunders, 2000. Evaluation of humic acid and other nonconventional fertilizer additives for onion production. *Oregon State Univ. Ontario*, 2000.
- Ghabbour, E.A. and G. Davies, 2001. *Humic substances: Structures, models and functions*, Royal Society of Chemistry, England.
- Ghonaime, A.A., G. Mona, G.S. Dawood, Riad and W.A. El-Tohamy, 2009. Effect of Nitrogen Forms and Biostimulants Foliar Application on the Growth, Yield and Chemical Composition of Hot Pepper Grown under Sandy Soil Conditions. *Research Journal of Agriculture and Biological Sciences*, 5(5): 840-852.
- Gomez, K.A. and A.A. Gomez, 1984. *Statistical procedures for agricultural research*. John Willey and Sons, NEW York, 680.
- Hacisefero, G.H.I., Y. Gezer; T. Bahtiyarca and H.O. Menges, 2003. Determination of some chemical and physical properties of faba bean (*Vicia faba* L.). *J. Food Eng.*, 60: 475-479.
- Hungria, M. and M.A.T. Vargas. 2000. Environmental factors affecting N₂ fixation ingrain legumes in the tropics, with an emphasis on Brazil. *Field Crop Res.* 65:151–164.
- Kadam, A.S. and S.S. Wadje, 2011. Role of potassium humate on growth and yield of soybean and black grAM. *Int J Pharm Bio Sci.* 2(1):242–246.
- Khaled, H. and H.A. Fawy, 2011. Effect of different levels of humic acids on the nutrient content, plant growth, and soil properties under conditions of salinity. *Soil Water Resour*, 6(1):21–29.
- Mahmoud, R. Asmaa, M. EL-Desuki, M. Mona, Abdel-Mouty and Aisha, H. Ali, 2013. Effect of Compost Levels and Yeast Extract Application on the Pea Plant Growth, Pod Yield and Quality. *Journal of Applied Sciences Research*, 9(1): 149-155.
- Mart, I., 2007. *Fertilizers, organic fertilizers, plant and agricultural fertilizers*. Agroand Food Business Newsletter pp. i-iv

- Mauromicale, G., M.G.L. Angela, and A.L. Monaco, 2011. The effect of organic supplementation of solarized soil on the quality of tomato. *Sci. Hort.*, 129(2): 189–196.
- Meganid, A.S., H.S. Al-Zahrani, and M.S. EL-Metwally, 2015. Effect of humic acid application on growth and chlorophyll contents of common bean plants (*Phaseolus vulgaris* L.) under salinity stress conditions. *Int. J. Inn. Res. Sci. EngTechnol.* 4(5): 2651–2660.
- Mikkelsen, R.L., 2005. Humic materials for agriculture, Davis, California, USA. *Better Crops with Plant Food*, 89 (3): 6–7.
- Morsi, M.K., B. El-Magoli, N.T. Saleh, E.M. El-Hadidy and H.A. Barakat, 2008. Study of antioxidants and anticancer activity licorice *Glycyrrhiza glabra* extracts. *Egyptian J. Nutr. And Feeds*, 2(33): 177-203.
- Nardi, S., D. Pizzeghello, A. Muscolo, and A. Vianello, 2002. Physiological effects of humic substances in plant growth. *Soil Biol Biochemistry*, 34(11):1527–1536.
- Neama, M.M., M.R. Shafeek, Y.I. Helmy, A.A. Ahmed and Magda, A.F. Shalaby, 2014. Effect of vitamin E and yeast extract foliar application on growth, pod yield and both green pod and seed yield of broad bean (*Vicia faba* L.) *Middle East Journal of Applied Sciences*, 4(1): 61-67.
- Pregl, F., 1945. *Guntitative organic micro-analysis* 1st Ed. J. and A. Churdill, Ltd. London.
- Shafeek, M.R., Y.I. Helmy, Nadia, M. Omer and Fatma A. Rizk, 2013. Effect of foliar fertilizer with nutritional compound and humic acid on growth and yield of broad bean plants under sandy soil conditions. *Journal of Applied Sciences Research*, 9(6): 3674-3680,
- Shehata, S.A., Y.M. Ahmed, T.Y. Emam and M.A. Azoz, 2012. Influence of some organic and inorganic fertilizers on vegetative growth, yield and yield components of cucumber plants. *Research J. of Agric. and Biolo. Sci.*, 8(2): 108-114.
- Srivastava, H.N., 1995. *Mineral nutrition, plant physiology*, 7th edn. Pradeep Publications, Jalandhar, 137.
- Trough, E. and A.H. Meyer, 1939. Improvements in denies colorimetric method for phosphorus andarsenic. *Ind. Eng. Chem. Anal. Ed.*, 1: 136- 139.
- Ulukan, H., 2008. Effect of soil application of humic acid at different sowing times on some yield components in wheat hybrids. *Int. J. Bot.*, 4(2): 164-175.
- Unlu, H.O., H. Unlu, Y. Karakurt and H. Padem, 2011. Changes in fruit yield and quality in response to foliar and soil humic acid application in cucumber. *Scientific Research and Essays*, 6(13): 2800-2803.
- Varanini, Z., R. Pinton, H.D. Behnke, U. Luttge, K. Esser, J.W. Kadereit, and M. Runge, 1995. Humic substances and plant nutrition. *Progress in botany: structural botany, physiology, genetics and taxonomy. Geo. Botany*, 56:97–117.
- Yeo, E., K. HawkBin, H. SangEun, L. JoonTak, R. JinChang, B. MyungOk, E.T. Yeo, H.B. Kwon, S.E. Han, J.T. Lee, J.C. Ryu and M.O. Byun, 2000. Genetic engineering of drought resistant potato plants by introduction of the trehalose-6-phosphate synthase (TPSI) gene from *Saccharomyces cerevisiae*. *Molecules and Cells*, 10(3): 263-268.
- Yildirim, E., 2007. Foliar and soil fertilization of humic acid affect productivity and quality of tomato. *Acta Agriculturae Scandinavica Section B-Soil Plant Science*, 57: 182-186.
- Zeng, K., 2002. Effect of dissolved humic substances on the phytochemical degradation rate of -aminopurence and atrazine. *J. Mol. Sci.*, 3:1048–1057.