Journal of Soil Sciences and Agricultural Engineering

Journal homepage: www.jssae.mans.edu.eg
Available online at: www.jssae.journals.ekb.eg

Effect of Humic Acid and Yeast Waste Application on Fababean (Vicia Faba) Yield, Yield Components and some Soil Properties of Salt Affected Soil

Cross Mark

Faten A. El-Kamar*

Soil, Water and Environ. Res. Institute, Agric. Res. Center, Giza, Egypt.

ABSTRACT

A field experiment was conducted during the two successive winter season 2018-2019 and 2019-2020 at Sahle El-Houssinia Agric. Res. Station, El-Sharkia Governorate to study the effect of foliar application of humic acid and yeast industrial waste (liquid and dried) on faba bean (Visia faba) yield, yield components and some soil properties of salt affected soil. The treatments were 8 gL, liquid yeast waste 6 cmL and dried yeast 10 gmL. Humic acid and yeast waste were sprayed during growth period four times every 10 days after 30 days from sowing by 600 L.ha^{-} on soil and plants. Application of humic acid and yeast waste (liquid or dried) decreased soil pH, EC, ESP, increased infiltration rate, porosity, stable aggregate and decreased bulk density for two seasons. Also, application of humic acid and yeast waste were significantly effect on plant height, number of branch / plant, number of pods plant, weight of 100 seeds, biological yield and seed yield. Seeds N, P, K, Fe, Zn, Mn contents significantly increased compared to control due to application humic acid, liquid yeast and dried yeast.

Keywords: Humic acid, yeast waste, fababean ,salt affected soil.

INTRODUCTION

According to final report of the Land Degradation Neutrality Target Setting Program (2018), the majority of salt affected soils in Egypt are located in northern-center part of Delta and on its eastern and western sides. About 2.8 million feddan suffer from salinization problem in cultivated area. Increase productivity and sustainability is very important to face population increase and increases in demand for energy food and shelter.

Faba bean (Visia faba) is on of the important crops raised in Egypt. It highly nutrition because of their high protein and it is good source of mineral nutrients, and vitamin. The inclusion of faba bean in cropping system improve soil fertility due to establishing symbiosis with specific Rizobium bacteria and concomitant biological nitrogen fixation, is associated with reduced need for fertilizer input and increase soil biological activity (Jonsen *et al*, 2012).

Humic substances are mixture of many molecules, some of which are based on motif aromatic nuclei with phenolic and carboxylic, linked together. The function group that contribute most surface charge and reactivity of humic substance are phenolic and carboxyl groups and around from 8 protenation of phenolate group (Piccob, 2002). The presence of carboxylate and phenolate group gives the humic acid the ability to form complex with ions such as Ca^{2+}, Mg^{2+}, Fe^{2+}. The formation of chelate complex is an important aspect of the biological role of humic acids in regulating bioavailability of metal ions (Ghobbuur and Davies, 2001).

Many investigators studied the effect of humic acid on plant growth and soil fertility. The favorite effect of application of humic acid on plant growth may be due to it form complexes with plant nutrients such as N, P, K, F, Zn and Mn and make them more available for plant (Rania and Goswam, 1988). Application of 10 kg humic acid soil application and 0.1% foliar spray to rice increased nutrient availability thereby improving soil fertility and productivity (Nandakumar *et al*., 2004).

Hussein and Hassan (2011), pointed out that humic acid play an important role in nutrient availability and physical, chemical and biological properties of soil. Application of 8 kg fed^{-1} increased seed protein (Abd El-Gawad, 2013).

Application of 9 liter fed^{-1} humic cid significantly increased wheat yield and concentration of N, P, K contents on grain (Eisa and Taha, 2010).

In study by El-Maaz and Ismail (2016), they found that application of 2 L fed^{-1}, humic acid as foliar spray to saline soil, significantly increased Egyptian clover yield, soil porosity and total stable aggregates.

The yeast production industry has been growing in Egypt over the last years, generating a large amount of sub products during alcohol fermentation. Yeast and yeast waste (CMS) is obtained from the processing and separation of yeast from must, rich in protein, carbohydrates, vitamins and some minerals. Decanted yeast waste (CMSD) is obtained by dentation of yeast waste (Mata, 2016). Previous studies concluded that yeast and yeast waste applied to plants increased plant growth and yield because it is a great source of plant nutrients, amino-acid, cytokinins essential for plant growth and yield (Marzauk *et al*., 2014, Khattab *et al*., 2015, Mata, 2016 and Xi *et al*., 2019).

Reda and Ismail (2008), pointed out that application of yeast extract, promote growth of plant grown in saline alkali soil such as plant stem, branch number and leaf. Application yeast by foliar spraying significantly increased vegetative, growth of pea plants, carbohydrate cytokinins, pod yield and quality and nutritive values. Addition of yeast extract 6 m L^{-1} significantly affect on plant growth as plant height, number of leaves, branch number, pods yield and contents of nitrogen and protein of faba bean plants (Marzauk *et al*., 2014).

* **Corresponding author.**
E-mail address: fatenalkamar@yahoo.com
DOI: 10.21608/jssae.2020.118340

Khattab *et al*. (2015), concluded that application of yeast (5 g.L^{-}) to faba bean plants significantly increased plant height, number of tiller, number of leaves, number of pods/plant, 100 g.seed, grain yield and straw yield of faba bean plant. Also seed protein content and N, P, K, F, Zn, and Mn increased. Application with yeast extract (10 g.L^{-}) significantly increased growth of faba bean at 65 and 85 days of sowing compared with control. Chlorophyll and phytohormone content increased at the age of 65 days. Yield parameter, as well as, seed protein and carbohydrate responded positively increased to yeast application (El-Shafey *et al*., 2016).

Nasser *et al*. (2016), pointed out reduction of vegetative growth caused by salt recovered by application of yeast extract. Application of yeast extract to rhizosphere soil -40 cm and foliar spraying with 2% three amount, increased plant growth, soil moisture contents, and decreased bulk density. The chemical properties were also improved as their was increase organic matter, phosphorus, nitrogen contents and decreased pH (Xi *et al*., 2019).

Application of yeast (6 g.L^{-}) to plant under salt stress improved physiological characteristics and fruit yield of sweet pepper compared with untreatment stressed plant (Abdelaal *et al*., 2019).

The objective of this work is studying the effect of foliar application of humaic acid and yeast industrial waste (liquid and dried) on faba bean (Visia faba) yield, yield components and some soil properties of salt affected soil.

MATERIALS AND METHODS

A field experiment was conducted during the two successive winter season 2018-2019 and 2019-2020 at Sahel El-Houssinia Agric. Res Station El-Sharkia Governorate, location lies between 32º/00 to 32º, 15, N latitude and 30º/50 to 3º/ 115 E longitude. The study aimed to determine the effect of humic acid, dried and liquid yeast waste application on soil physical and chemical properties and faba bean plants grown on salt affected soil. The experiment design was a complete randomized block with three replicates. The treatments were humic acid 8/gL, liquid yeast waste 6 cm./L and dried yeast waste 10 gmL. Humic acid, yeast waste was sprayed during growth period four times every 10 days after 30 days from sowing by 600 L ha^{-1} on soil and plant. Yeast waste were obtained from Angel Yeast Egypt Co. L.T.D.

Yeast extract was prepared from solid yeast by dissolved 8 gm/L dried yeast waste following by adding sugar at rate 1 : 1 and kept for 24 hour in warm place (Mady, 2009).

The main physical and chemical properties of the experimental soil properties were determined according to the methods described by (Klute, (1986). The obtained data is recorded in Table 1 and 2.

Faba bean seed, cultivar planted at a rate 150 k.ha^{-} during the winter season (15/11/2018 and 20/11/2019). All plots received 130 kg Na ha^{-} as ammonium sulphate, 400 kg h^{-} calcium super phosphate and 120 kg ha^{-} potassium sulphate. Calcium super phosphate was added before planting during the soil preparation and ammonium sulfate and potassium sulphate were added after planting in three equal doses after 20, 40 and 60 days from sowing.

After faba bean maturity samples were taken to determine plant height, branch number/plant,pods number/plant.

The weight of biological yield was estimated in the net plots and separated into seed and straw then weighted. Samples from grain and straw were taken, dried on oven at 70ºC for 24 hour for chemical analyses. Soil samples of experimental sites were taken at depth 40 cm before sowing and after harvesting for analysis (Table 1), soil bulk density (BD) was estimated in undistributed soil samples using steel ring 100 cm^3, soil pH was determined in 1:2.5 soil water suspension using pH meter and E.C. d Sm^{-1} was determined in soil paste by EC meter according to Page *et al*. (1982). Organic carbon content was determined in the soil sample by the modified Walkaly and Black methods as outlined by Sparks *et al*. (1996). Available nutrients were determined in the soil samples according to the procedures described by Page *et al*. (1982), as follows: 1- available N was extracted by K_2SO_4 (1%) and then determined using micro kjeldahle. 2- Available P was extracted by $NaHCO_3$ (0.5 N pH 8.5) then determined spectrophotometrically. 3- Available K was extracted by ammonium acetate then determined by phlam photometer. 4- Available Fe, Mn and Zn were extracted by ammonium acetate DTPA according to Soltan-Pour and Schwab (1977) and then determined with atomic absorption photometer (Perken-Elmer,372).

Plant samples were oven dried at 70ºC for 24h, and grounded. Plant portion equivalent to 0.29 were digested using mixture of concentrated sulphuric acid and perchloric acid ratio 2:1 as outlined by (Black,1965) afterwards, the digested was dilute to volume of 100 ml deionized water. The total N in plant determined micro-Kjeldahl apparatus, phosphorus was determined, spectro-photometrically using ammonium-molybdate / stannus chlorides. Potassium was determined by phlame photometer according to Page *et al.* (1982). F, Zn and Mn were determined by using atomic adsorption model (Model GBC, 932).

Chlorophyll a, b and carotenoids were colorimetrically determines in fresh leaves of faba bean plants at 65 days after sowing in the methods described by Moran (1982). Brolin was assayed according to the methods described by Bates *et al*. (1973).

Statistical Analysis:

All measurements were carried out in triplicate. The statistical significant of treatment effect calculated with LSD produced at P = 0.05 (Sneidecor and Cochran ,1976) using SAS program (SAS Institute, 1982)

Table 1. Some physical properties of studied soil.

K m/d	IR Cm h	F.C %	W.P %	A.W %	B D Mg m3	Practical soil distribution %			Texture
						Sand	Silt	Clay	
0.18	0.29	37.3	17.3	23.6	1.41	28.3	25.6	46.1	Clay

I.R.: Infiltration rate FC: field capacity. BD: Bulk density.
Aw: available water k:Hydrolic conductivity
EC d Sm^{-1} (soil paste), ESP: exchangeable sodium percentage, CEC: cation exchange capacity, OM: organic matter

Available macro and micro nutrients. mg/kg

Macronutrients			Micronutrients		
N	P	K	Fe	Zn	Mn
28	4.8	250	3.5	0.85	1.4

Table 2. Some chemical properties of studied soil.

pH 1: 2.5 Soil water	ECdSm^{-1}	% ESP	meq/L							C.E.C. Cmolc Kg^{-1}	O.M. %	$CaCO_3$ %
			Soluble cations				Soluble anions					
			Ca^{++}	Mg++	K^+	Na^+	Cl^-	HCO_3^-	SO4^{--}			
8.4	8.7	17.2	14.6	25.3	1.8	45.3	38.2	5.5	43.3	33.4	0.9	7.2

Table 3. Chemical analysis of humic acid, liquid and dried waste yeast

Dried yeast waste		Liquid yeast waste		Humic acid	
Organic matter	**58.3 %**	**Total N.**	**4.4 %**	**Organic matter**	**72 %**
Organic carbon	38.8%	P_2O_5	0.2%	N	1.98%
Total N	4.6%	K2O	9.8%	P	0.36%
P	0.1%	Ca	0.87%	K	3.4%
K_2SO_4	16.9%	Mg	0.16%	Fe	395 mg/kg
Ca	3.31%	S	1.04	Zn	32 mg/kg
Mg	0.27%	B	8.5 mqL	Mn	249 mg/kg
S	11.47%	Mo	5.3 mqL		
Bo	13.5 mg	Fe	71.0 mqL		
Fe	129.4 mg	Mn	11.3 mq/L		
Mn	0.002 mg	Zn	483 mqL		
Zn	378 mg	Cu	5.3 mqL		
Cu	3.3 mg	Total amino acid	20.1%		
Potassium humate	15%	Free amino acid	7.9%		
Humic acid	7.5%	Organic matter	59%		
Fulvic acid	5%	Organic carbon	34.66%		

RESULTS AND DISCUSSION

Effect of humic acid, liquid yeast waste and dried waste yield on soil physical characteristics:

The application of humic acid significantly (Table 4), affected the soil infiltration rate for two seasons. Application of humic acid increased infiltration rate from 0.29 to 0.36 cm/h for the first year and from 0.26 to 0.38 cm/h for second year. Bulk density decreased from 1.48 to 1.36 Mg m^3 and from 1.45 to 1.33 Mg m^3 for the first and second year respectively. Porosity increased from 43.2 to 49.5 and from 43.5 to 50.2% for the first and second year, respectively. Rosa *et al*. (2005), stated that application of humic acid significantly affect the physical and chemical characteristic of soil as aggregate stability, buffering capacity bioavailability and complexation of metal. El-Maaz and Ismail (2016), found that application of humic acid to salt affected soil affected significantly the soil aggregation, decreased bulk density, increased porosity. Pen-Mendez *et al*. (2005), stated that application of humic acid can increase aggregate stability which leads to improve physical properties of saline soil.

Table 4. Effect of humic acid, liquid yeast waste and dried yeast waste on soil chemical and physical analysis.

Treatments	2018-2019				2019-2020			
	IR Cm/H	BD Mg/m³	Porosity	Stable aggregate %	IR Cm/H	BD Mg/m³	Porosity	Stable aggregate
Control	0.29	1.48	43.2	23.6	0.26	1.45	43.5	25.2
Humic	0.36	1.36	49.5	34.1	0.38	1.33	50.2	36.1
liquid Yeast waste	0.33	1.39	46.5	29.9	0.32	1.38	48.5	32.2
Dried Yeast waste	0.32	1.40	46.0	28.8	0.31	1.39	48.5	30.2
L.S.D.	0.05	0.03	0.5	6.85	0.04		2.1	2.5

IR: Infiltration rate, BD: bulk density.

Application of liquid yeast waste had a positive effect on soil physical properties, liquid yeast waste application increased infiltration rates from 0.29 to 0.33 cm/h and from 0.26 to 0.32 cm/h for first year and second year respectively. Bulk density decreased from 1.48 to 1.39 Mg m^3 and from 1.45 to 138 Mg m^3, for first and second year respectively. Porosity increased from 43.2% to 46.5 and from 43.5 to 48.5% for first and second year.

Also, dried yeast waste application increased soil infiltration rate from 0.29 cm/h to 32 cm/h and from 0.26 m^3 ha^- to 31 cm/h, decreased bulk density from 1.48 to 1.38 and from 1.48 to 1.38, and from 1.45 to 1.39 Mg m^3 and increased porosity from 43.2 to 46.0 Mg m^3 and from 43.5 and 48.5 and increased stable aggregate from 23.6 Mg m^3 to 28.8% and from 25.2 to 30.2, % for the first and second year respectively.

The promotion effect of yeast waste on soil physical properties may be attributed to agglutination of soil particles by yeast waste. The organic mattar from yeast waste stimulate the microbial activity in soil which bring more decomposition of organic matter which lead to formation stable aggregates, more capillary poros and decrease bulck density and increase porosity (Liang *et al*., 2014 and Xi *et al*., 2019). Also, the polymeric substances in cell wall of yeast such as ex-polysaccharide have effect on binding soil particles together lead to increase soil aggregation and porosity (Raspor, and Zopan, 2006).

Effect of humic acid, liquid yeast waste and dried yeast waste on soil chemical characteristics:

Data found in Table (5), showed that application of humic acid had significantly effect on the chemical properties of salt affected soil. In first year soil, pH decreased from 8.3 to 7.95 unit, EC decreased from 8.4 to 6.5 d Sm^{-1}, E.S.P. decrease from 16.2 to 11.9% and organic matter increased from 0.93 to 1.1%. The same trend were obtained for the second year, where soil pH decreased from 8.4 to 8.1 unit, soil E.C. decreased from 8.7 to 6.5 d Sm^{-1}, E.S.P. decreased from 1.2 to 12.1% and organic matter increased from 1.1 to 1.3%.

Table 5. Effect of humic acid, liquid yeast waste and dried yeast waste on soil chemical and physical analysis.

Treatments	2018-2019				2019-2020			
	pH	EC d Sm⁻¹	ESP %	OM %	pH	EC d Sm⁻¹	ESP %	OM %
Control	8.3	8.4	16.2	093	8.4	8.7	17.1	1.10
Humic	7.95	6.5	11.9	1.10	8.1	6.6	12.6	1.30
liquid Yeast waste	8.10	6.8	12.8	1.15	8.2	7.1	13.2	1.22
Driec Yeast waste	8.10	6.9	12.9	1.16	8.2	7.2	12.5	1.20
L.S.D.	N.S.	1.1	2.1	0.05	N.S.	1.2	1.9	0.04

EC: electric conductivity, ESP: exchangeable sodium percentage, OM: Organic matter.

The beneficial effect of humic acid application on soil chemical properties may be due to release of H^+ from HA replace the Na^{++} exchange sites and leached down of soil profile, that the result of such procedures is to reduce pH and also decreased dispersion of clay which lead to decrease the EC and pH due to increase infiltration rate of soil and leached salt down of soil profile (Chabara, 1994, Raych, 2014 and Mindari *et al*. 2019).

Application of both liquid and dried yeast waste had significant effect on soil chemical properties (Table 5). Soil pH decreased from 8.3 to 8.1 and EC decreased from 8.4 to 6.8 dSm^-, E.S.P. decreased from 16.2 to 12.8% and organic matter increased 0.93 to 1.15, for the second year pH decreased from application of liquid yeast in the first year. Dried yeast waste decreased pH from 8.3 to 8.1, and EC from 8.4 d Sm^{-1} to 6.9 dSm^{-1} and ESP decreased from 16.2 to 12.9%.

The beneficial effects of yeast waste may be due to that yeast contains amino acids, such glycine and glutamine, when pH of soil is higher than amino acids, the polar amino acid release protons keeping negative charge which attract Ca^{2+} ions from calcium carbonate causing an increase in the ion concentration of calcium which replace Na^{+1} in soil clay (Rasport and Zupan, 2006).

Gadd (1993), pointed out that yeast interaction with cations in soil, affect on their chemical and physical properties. The organic acid release from the biochemical activity of yeast can affect cations speciation and mobility in the soil. Organic acid provide both source of protons for solubilizing and metal-chelating anion to complex the metal cations (Devever *et al*., 1996). They have the double function: (1) to acidify the substrate thus enhancing ion solubility, and to form complexes with solubilized ions which leads to ion mobilization (Gadd, 1999). These data confirmed with the data obtained by Nasser *et al.* (2016), and Xi *et al.* (2019).

Effect of treatments on soil available N, P, K, Fe, Zn, Mn:

Application of humic acid, liquid yeast and dried yeast significantly increased soil available N, P, K, Fe, Zn and Mn (Table 6). The relative increase, over control were 29.16, 20.90 an 12.5% for N, 44.9, 36.7 and 26% for P and 28.0, 22.0 and 16% for K due to application of humic acid, liquid and dried yeast waste, respectively, in the first season. The relative increase over control were 25, 17.8 and 14.2 for N, 47.1, 35.29 and 29.4 for P and 34.78, 21.7 and 13.9 for K in the second season, in the same order. For soil available Fe, Zn and Mn, the relative increase was 42.1, 26.3 and 18.4% for F, 41.18, 29.4 and 15.29% for Zn and 37.5, 18.75 and 12.5% for Mn due to additional of humic acid, liquid and dried yeast waste respectively in the first year. For the second year the relative increase was 51.61, 32.28 and 25.8% for F, 42.86, 31.8, 20.88% for Zn and 66.67, 60 and 26.6% for Mn, due to application of humic acid liquid and dried yeast waste respectively. The beneficial effect of humic acid and yeast on availability of plant nutrients may be due to their effect on soil physical and chemical properties such as decreased EC, pH, increased infiltration and porosity. Also, humic acid and yeast waste contain some nutrients, which release in available form (Mata, 2016).

Surface charge on yeast cell and carboxylate and phenolate group gives yeast waste and humic acid, the ability to form complex with nutrients prevent them from leaching through profile (Piccub, 2002). These results are in line of those obtained by Gadd (1999), Hussein and Hassan (2011), Khaled and Fawzy (2011) and Mandari *et al*, (2014).

Table 6. Effect of humic acid, liquid yeast waste and dried yeast waste on available, N, P, K, Fe, Zn and Mn concentration of soil after harvesting.

Treatments	2018-2019 mg/kg					
	N	**P**	**K**	**Fe**	**Zn**	**Mn**
Control	23	4.9	250	3.8	0.85	1.6
Humic	31	7.1	320	5.4	1.2	2.4
liquid Yeast waste	29	6.7	305	4.8	1.1	2.1
dried Yeast waste	27	6.2	290	4.5	0.98	1.9
L.S.D. 0.05	2.9	0.55	19.50	0.12	0.05	0.21
	2019-2020 mg/kg					
	N	P	K	Fe	Zn	Mn
Control	28	5.1	230	3.1	0.91	1.5
Humic	35	7.5	3.0	4.7	1.3	2.5
liquid Yeast waste	33	6.9	280	4.1	1.2	2.1
dried Yeast waste	32	6.6	262	3.9	1.1	1.8
L.S.D. 0.05	2.1	0.45	18.2	0.15	0.04	0.19

Effect of humic acid, liquid yeast waste and dried yeast waste on faba bean yield and its components:

Data presented in Table (7) show that the application of humic acid, liquid and dried yeast waste on faba bean plant significantly increased plant height, branch number / plant pods No. / plant, weight of 100 seed gm, seed yield and straw yield for two seasons.

Table 7. Effect of humic acid, liquid yeast waste and dried yeast waste on faba bean growth parameter, yield and yield components.

Treatments	First Year 2018-2019							
	Plant Height cm	**Branch No. Plant**	**Puds No. plant**	**Seed No. plant**	**Weight of 100 seed g**	**Biological yield Mgh⁻**	**Seed yield Mg-h**	**Harvest Index %**
Control	85	3.50	16	45	70	7.67	3.13	40.81
Humic	97	4.40	23	61	88	9.3	4.10	44.10
liquid yeast waste	95	4.30	20	59	83	8.86	3.90	44.90
Dried yeast waste	93	3.90	18	55	80	8.6	3.70	43.00
L.S.D. 0.05	3.3	0.31	1.9	4.1	8.1	0.45	0.31	2.10
	Second Year 2019-2020							
	Plant Height Cm	Branch No. Plant	Puds No. plant	Seed No. plant	Weight of 100 seed	Biological yield Mgh⁻	Seed yield Mg-h	Harvest Index %
Control	80	3.3	14	44	68	6.50	2.63	40.46
Humic	93	4.1	19	57	84	8.37	3.8	43.00
Liquid yeast waste	89	3.9	17	53	80	7.82	3.54	45.29
Dried yeast waste	87	3.8	16	51	77	7.41	3.22	43.4
L.S.D. 0.05	3.5	0.29	1.5	2.1	5.1	0.61	0.32	2.25

Humic application increased plant height, branch No. / plant, pods No. / plant and seed No. / plant by 14.1, 25.7, 43.75, 35.6% respectively in the first year. The relative increase over control for biological yield and seed yield were 21.3% and 31% respectively. The same trend was obtained at the second year.

The benefit effect of humic acid on yield and yield components may be due that the presence of carboxylate and phenolate group on the surface of humic acid form complex with ions such as Cu^{+}, Mg^{+}, Fe^{2+} and then more available for plant (Ghobbuur and Davies, 2001). Also, application of Humic acid had significantly affect on physical, chemical and biological properties of soil which reflect on plant growth (Hussien and Hassan, 2011 and El-Maaz *et al*., 2011). These data confirmed with the data obtained by Abdel-G. Wad (2013),El Maaz and Ismail, (2016), and Yousf *et al.* (2019).

Application of yeast waste dried or liquid significantly increased yield and yield components of faba bean. The relative increase over control for liquid yeast were 19.7, 22.9, 25.0, 13.1 and 18.6 for plant height branch number / plant, pods number / plant and weight of 100 seeds respectively, where relative increase in biological yield and seed yield were 15.5 and 24.6% respectively.

The relative increase over control for application of dried yeast waste were 8.8, 15.15, 28.6, 13.7, 13.2% for plant height, branch, branch number pods / plant, and weight 100 seeds. The data obtained from this paper confirmed with that obtained by Marzauk *et al.* (2014), Khattab *et al.* (2015), El-Shafey *et al.* (2016), and Nasser *et al.* (2016), who found that yeast application had a significant effect on plant growth yield and yield components.

The positive effect of yeast waste application on plant growth, yield and yield quality in salt affected soil may be because it contains amino acid, trace elements, gibberellins, auxins and cytokinins that improve plant growth and mitigated the adverse effect of salinity (Yousef *et al.* 2019, Nasser *et al.* 2016, Xi *et al*., 2019 and Abdelaal *et al*., 2019), pointed out that reduction of vegetative growth of plant grown in salt affected improved by application of yeast extract (6 gm L.) due to good effect on soil chemical and physical properties and physiological characteristics of plants.

Effect of Treatments on N, P, K, Fe, Zn and Mn in faba bean seed:

Table (8) shows the effect of humic acid, liquid and dried yeast waste on N, P, K, Fe, Zn and Mn concentration on faba bean seed. The relative increase of N over control were 31.0, 20 and 17.70% for the first year and were 38.4, 26.9 and 19.2% for the second year due application humic liquid and dried yeast waste respectively. Phosphorous concentration, increased by 23.1, 15.4, 9.2% and 43.3, 33.3, 25.1 over control for application of humic acid liquid yeast dried waste year for first and second year respectively. Potassium concentration increased by 0, 31.3, 18.85 and 44.4, 27.8, 16.7% over control for application of humic acid liquid and, dried, yeast at first and second year respectively. Also, Fe, Zn and Mn concentration of faba bean seeds significantly increased with application of humic acid liquid and dried yeast. The relative increased over control 22.6, 15.3 and 11.3 and 23.1, 13.9 and 15.4% for F, and 50, 27.8, 16.6 and 56.5, 31.11 and 18.8 for Zn, and 41.2, 29.4, 17.6% and 33.3, 26.7, 20% for Mn in first year and second year respectively due to application of humic acid liquid and dried yeast waste respectively.

The beneficial effect of humic and yeast waste may be humic acid contains high organic contents which effect on soil physical and chemical properties and also it chelates nutrients prevent them leaching through soil profile and make them more available for plants. Also, yeast waste contains many nutrients and growth regulator and amino acid which increase root growth and absorb more nutrients from soil. These data are confirmed with the data obtained by Reda and Ismail (2009), Marzauk *et al*. (2014), Nasser *et al*. (2016), and Yousf *et al*. (2019).

Effect of treatments on photosynthetically active pigments:

The concentration of photosynthetically active pigments (Ch. A, Chl. B and carotenoids) of faba bean plant are shown in Table (9). Application of humic acid, and liquid and dry yeast waste significantly increased Chl.A, Chl.B and carotenoids contents of faba bean leaves. This results indicated that the increase in concentration of total photosynthetic pigment in response to biostimulation of humic acid and yeast waste treatments.

Table 8. Effect of humic acid, liquid and dried yeast waste on chlorophyll and proline contents of faba bean leaves.

Treatments	Chl. B mg/gm	Chl. (B) mg/gm	A+B mg/gm	Carotenoid mg/g	Proline mg/gm dry weight
2018-2019 mg/g Fresh Weight					
Control	1.24	0.64	1.88	0.71	0.90
Humic	1.61	0.82	2.43	0.91	0.75
Liquid yeast waste	1.55	0.79	2.34	0.85	0.72
Dried yeast waste	1.50	0.75	2.25	0.83	0.69
L.S.D. 0.05	0.15	0.095		0.055	0.1
2019-2020 mg/g Fresh Weight					
Control	1.35	0.67	2.02	0.75	1.1
Humic	1.72	0.90	2.62	0.98	0.70
Liquid yeast waste	1.63	0.81	2.44	0.88	0.80
Dried yeast waste	1.60	0.79	2.39	0.86	082
L.S.D. 0.05	0.11	0.10		0.042	0.08

The effect of humic acid and yeast waste (liquid or solid) application (Table 9), significantly decreased proline concentration compared to untreated plant. Mady (2009), stated that application of yeast extract on faba bean significantly decreased chlorophyll a, b and carotenoids. These increases may be enhanced plant growth and yield. These data confirmed with that obtained by Mindari *et al.* (2014),El Shafey *et al.* (2016), and Abdelaal (2019)

Table 9. Effect of humic acid, liquid yeast waste and dried yeast waste on N, P, K, Fe, Zn and Mn contents of faba bean seed.

	%						mg/Kg					
	N		P		K		Fe		Zn		Mn	
	First year	Second year	First year	Second year	First year	Second year	First year	Second year	First year	Second year	First year	Second year
Control	2.9	2.6	0.65	0.60	1.6	1.8	124	130	18	16	17	15
Humic	3.8	3.6	0.80	0.86	2.4	2.6	152	160	27	25	24	20
dried yeast waste	3.5	3.3	0.75	0.80	2.1	2.3	143	148	23	21	22	19
Liquid yeast waste	3.3	3.1	0.71	0.75	1.9	2.1	138	150	21	19	20	18
L.S.D. 0.05	0.2	0.18	0.04	0.05	0.12	0.15	9.5	5.9	2.1	1.9	2.3	1.8

REFERENCES

Abd El-Gawad, M.A.a. (2013): Effect of humic acid application as well as bio and mineral phosphorus fertilization on growth, green pods, ry seed yield and quality of peas (Pisum stivum L.), under the newly reclaimed soil condition. Egypt. J. Appl. Sci., 28(7):338-360.

Abdelaal, K.A., El-Mghraby, L.M., El-Ansary, H., Hafez, Y.M., Ebrahim, El-Banna, M. El-Esawi, M. and El-Sheilish, A. (2019): Stress oxidative damage by mediating the physio-biochemical and antioxidant system. Agronomy, 10-26:1-15.

Bates, L.S., Waldren, R.P., Tean, I.D. (1973): Rapid determination of free proline far water-stress studied. Plant. Soil. 39:205-207.

Black, C. A. (ed.) (1965). Methods of soil analysis. PartII Agronomy. Amer. Soc. Of Agron., Madison, W. S. USA.

Chabara, R. (1994): “Soil salinity and water quality”. Oxford and IBH Publ. Co. New Delhi.

Devever, O., Garbaye, J. and Botton, B. (1996): Release of complexing organic acid by rizosphere fungi as factor Norway spruce yellowing in acidic soils. Mycological Research, 100:1367-1374.

Eisa, L.A. and Taha, M.B. (2010): Improving productivity of wheat plants by adding humic acid and iron-chelates. Egypt. J. Soil. Sci., No. 1:15-26.

El-Maaz, E.T.M. and Ismail, F.H.S. (2016): Impact of Bio-fertilizer, humic acid-and compost T application on soil properties and Egyptian clover productivity under saline soil conditions. J. Soil. Sci. and Agric. Eng., Mansoura Univ., Vol. 7(9):611-622.

El-Shafey, A., El-Fekyh, S. and Abo-Hamada,S.A. (2016): Effect of sowing time and foliar application of yeast extract on growth and productivity of different cultivars of faba bean (Visia Faba L.). Egypt. J. Bot., 56, No. 1, pp. 35-48.

Final Report Country Report of the Land Degradation Neutrality Target Setting Programme, (January, 2018): Arab Republic of Egypt, Ministry of Agriculture, and Land Reclamation, Desert Research Center (2018).

Gadd, G.M. (1993): Interaction of fungi with toxic metals. The New Pytologist, 124:25-60.

Gadd, G.M. (1999): Fungal production of citric and oxylic acid. Importance in metal speciation, physiology and biogeochemical processes. Advances in Microbial Physiology, 41:47-92.

Ghabbour, F.A. and Davies, G. (2001): Humic substances structures model and functions, Cambridge, U.K. Rsc. Publishing, ISBN, 978-0-85-85404-811-3.

Hussein, KH. and Hassan A.F. (2011). Effect of different levels of humic acids on the nutrient, plant growth and soil properties under condition of salinity. Soil and Water Res. 6(1):21-29.

Jonsen, E., Peoples, M.B., Body, R.M., Gressho, P.M., Havgaard-Nielson, H. and Alevs, B.J.R., (2012). Legume for mitigation of climate change and the provision of feed stock for biofuels and bioenergies. A Review. Agro. Sustain. Dev.,32:319-61.

Khaled, H. and Fawzy, H.A. (2011): Effect of different level of humic acid on nutrient content, plant growth and soil properties under conditions of salinity. Soil Water Res. 6(1):21-29.

Khattab, E.A., El-Dewiy, C.Y., Afifi and R. Kh. Khalifa M.H. (2015): Response of some varieties of faba bean to yeast and Alge and their impact on yield and its components. Middle East Jour. Of Agric., 4(4):907-913.

Klute, A (1986). "Physical and Mineralogical methods". ASA-SSSA-Agronomy, Madison, Wisconsin USA

Liang, L.B., Xu, J.M. and Zang, X.H. (2014): Effect of microbial fertilizer ad organic-chemical fertilizer on properties of calcareous soil in north China. J. Irrig. Drain, 33, 105-108.

Mady, M.A. (2009): Effect of foliar application with yeast extract and zinc on fruit setting and yield of faba bean (Vicia faba L). Environ. Sci. 2009, Volume 4(2):109-1027.

Marzauk, N.M., Shafeek, M.R., Helmy, Y.I. Ahmed A.A. and Magda, Shalaby A.F (2014): Effect of vitamin E and yeast extract foliar application on growth, pod yield and both green pod and seed yield of broad bean (visia faba L). Middle East Jour. Of Appl. Sci., 4(1):61-67.

Mata (2016): Assessment of environmental of yeast waste application on soil. An integrated approach. M.Sc. Lischbona, Brazil.

Mindari, W., Aini, N., Kusuma, Z. and Syekhfan, K. (2014). Effect of humic acid-based buffer + cation on chemical characteristics of saline soils and maize growth. Jour. Of Degraded and Mining Land Management. 2, 1:259-268.

Mohamed, W.H. (2012). Effect of humic acid and calcium forms on dry weight and nutrient uptake of maize plant under saline soil condition. Austr. J. Basic and Appl. Sci., 6(8):597-604.

Moran, R. (1982). Formulate for determination of chlorphyllous pigments extracted with N,N-Dimethyl I formamide. 1. Plant Physio., 69, 1376-1381.

Nandakumar R., Sarnanan, A., Sincgara, P. and Chandrasekaran, A., Singgara,P. and Chandrasekaran, B. (2004). Effect of lignite humic acid on soil nutrient availability at different growth stage of rich grown on vertisol and alfisols. Acta. Agron. Hungaria, 52(3):227-235.

Nasser, R.H., Shanan, N.T. and Reda, F.M. (2016). Active yeast extract counteracts the harmful effect of saline soil stress on the growth of leucaena plant. Si. Hortic., 201:61-67.

Page, A.L. R.H., Miller and D.R. Keeney (1982). "Methods of chemical analysis", part 2. Chemical and microbiological analysis. American Society of Agronomy. Inc. and Sci. Soc. America, Madison, Wisconsin, U.S.A.

Pen-Mendez (2005). Humic acid substances, compounds of still unknown structure: application in agriculture industry, environment and biomedicine. Jour. Of App. Biomedicine, 3:13-26.

Piccob, A. (2002). The supermolecular structure humic substances. A novel under standing of humus chemistry and implications in soil science. Advances in Agron.,75:pp.57-134.

Raina, R. and Goswam, K.P. (1988). Effect of fulvates on growth and nutrient uptake by maiz plant. J. Indian Soc. Soc. Sci., 36:264-268.

Raspor, P.,and Zopan, J. (2006). Yeast in extreme environments. Yeast Handbook, Biodiversity and Ecophysiology of yeast. Springer-Verlag, Berlin, 371-417.

Raych, T., Popandova, S., Jozefaciuk, G., Hajnos,and M., Sokoowska, Z. (2001). Physio-chemcal, reclamation of saline soils using coal powder. Int. Agrophysics, 15:51-54.

Reda, F.M. and Ismail, F.M. (2008). The influence of spraying with active yeast extract on vegetative growth and volatile oil of river red gu plant (Eucalyptus camaldulensis, Dehn.). J. Agric. Sci., 33:425-434.

Rosa, A.H. Simoes, M.L., Oliveira, L.C., Neto, L.M., and Milori, D.M.B. (2005). Multimethod study of the degree of humification of humic substances extracted from different tropical soil profiles in Brail's Amazon region. Geoderma, 127, 1-10.

Snedecor, C. W. and Cochran, W. G. (1976). Statistical methods 6th ed., iowa state Univ. press, iowa, USA.

Soltan Pour, N. and Schwab, A.P. (1977): "A new soil test for simultaneous extraction of macro and micronutrients in alkaline soils. Common Soil. Sci., Plant. Anal., 3:195.

Sparks, D.L., Page, A.L., Helmke, P., Leppert, R.H., Johnson, M.A. and Sumer, M.E. (1996): Methods of soil analysis. Part 3 – chemical analysis, Madison, W.I., Soil. Science Society of America, 1358.

Xi, Qin, Lai, W., Cui, Y., Haibong, W.u and Zang T. (2019). Effect of yeast extract on seeding growth promotion and soil improvement in afforestation in a semiarid chestnut. Soil. Agrea Forest., 10, 76:1-16.

Yousf, S.H., Korditan, Y.H. and Sana, S.H. (2019). Effect of bread yeast and humic acid on growth and yield traits of broad bean (Visia faba L.). Jour. Of Univ. of Duhok, Vol. 22, NO. 11, pp: 98-106.

تأثير إضافة حامض الهيومك ومخلفات صناعة الخميرة علي محصول الفول البلدي ومكوناته وعلي صفات الاراضي المتأثرة بالاملاح

فاتن عبد العزيز عباس الكمار*

معهد بحوث الاراضي والمياه والبيئة- مركز البحوث الزراعية

أقيمت تجربة حقلية خلال الموسم الشتوي 2018-2019/ 2019-2020 في محطة البحوث الزراعية بسهل الحسينية- مركز البحوث الزراعية لدراسة تأثير اضافة حمض الهيومك ومخلفات صناعة الخميرة السائلة والجافة علي محصول الفول البلدي ومكوناته وعلي صفات الاراضي الملحية وكانت المعاملات كالتالي: اضافة حامض الهيومك رشا بمعدل 8 جم/لتر ومخلفات الخميرة السائلة بمعدل 6 سم/لتر ومخلفات الخميرة الجافة بمعدل 10 جم/ لتر ثم رش جميع المعاملات ب 600 لتر هكتار 4 مرات كل 10 ايام بعد الزراعة ب 30 يوم. أظهرت النتائج: 1-ادى اضافة حامض الهيوميك ومخلفات الخميرة (السائلة والجافة) الى تحسين فى خواص الاراضى حيث اتخفض ملوحة التربة (Ec dSm^{-1}), pH and SAR وكذلك ارتفعت نفاذية التربة والمسامية والتجمعات الثابتة 2- كان لإضافة حامض الهيومك ومخلفات الخميرة السائلة والصلبة تأثير معنوي علي محصول الفول البلدي ومكوناته وكذلك علي تركيز عناصر النيتروجين والفوسفور والبوتاسيوم والحديد والزنك والمنجنيز.