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Some Agricultural Practices to Improve the Growth and Yield of the Cucumber during the Winter Season in the Open Fields

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ABSTRACT

The field work was carried out at the Experimental Farm of the Desert Research Center of Siwa Oasis, Marsa Matroh Governorate, during the two consecutive seasons of 2015/2016 and 2016/2017. The experiments were conducted to investigate the effect of humic acid, Bio fertilizer and mixing between them as soil addition and foliar spray by two compounds of amino acids on growth, yield and chemical composition of cucumber plant Bahy cv. Results revealed that the highest values of plant height and weight; shoot and root dry matter percent; No. of leaves/plant; Leaves area; No. of fruits/plant; fruit length and weight; plant yield; early and total yield as well as fruit chemical contents were recorded with mixing between Humic acied and Biofertilizer treatment followed by Humic acid alone treatment. No significant differences occurred among both treatments in all most growth; yield and chemicals contents parameters in both seasons except biofertilizer treatment had the highest values in No. of branches/plant in both growing seasons and the highest values in K (%) and total carbohydrate (%) in second season only. Foliar spray by A 15% at the rate of 2ml/L showed significant increase in plant height; No. of leaves/plant; No. of fruit/plant; fruit weight; plant yield; early and total yield and N (%) in both seasons. Also, B 20% at the rate of 0.5ml/L showed the highest values in shoot and fruit dry matter percent; total chlorophyll and P(%) in both gowning seasons. Positive correlations were existed between study parameters and the regression coefficients (b) indicated that for each increase of one leaf/plant, number of fruits/plant correspondingly increased by 0.36 and 0.31 fruit and for each increase of one fruit/plant, total yield correspondingly increased by 0.69 and 0.78 ton/fed in the first and second seasons, respectively.

Keywords: Cucumber –Growth – Yield - Chemical composition- Humic acid, Bio fertilizer- Amino acid

INTRODUCTION

Cucumber (*Cucumis sativus* L.) is one of the most important and popular vegetable crops belonging to the family Cucurbitaceae, it is a source of vitamins and minerals for human body. The Cucumber is protective supplementary food and considered as a short duration crop and gives high yield, it is important from an economic point of especially the area under its cultivation to increas gradually in the newly reclaimed lands. In Egypt, total cultivated area in 2018 is 20557 fed., and the total production is 457795 ton. It is one of the most important exported crops (FAO. STAT 2018)

Humic acid is a promising natural resource that can be used as an alternative to synthetic fertilizers to increase crop production. It exerts either a direct effect, such as on enzymatic activities and membrane permeability, or an indirect effect, mainly by changing the soil structure (Biondi *et al.*, 1994). However, the mechanism responsible for this Humic acid biological action is poorly understood (Baigorri *et al.*, 2007). Whereas some authors propose that Humic acid promote plant growth by improving the soil bioavailability of certain nutrients, principally iron and zinc (Chen *et al.*, 2004a; b), others suggest that Humic acid can also directly affect plant metabolism (Nardi *et al.*, 2002) or increase catalysis, stimulating respiration, photosynthesis, nucleic acid metabolism, hormonal activity and substances stimulate shoot and root growth and nutrient uptake of vegetable crops (Akinremi *et al.*, 2000; Serenella *et al.*, 2002 ؛ Cimrin and Yilmaz, 2005). Moreover, humic acid had positive effect on individual roots morphological as cell number, cell size, cell type, lateral roots, or absorbent hairs and the whole root as root architecture, principal secondary root density and branching, and root thickness (Schmidt *et al.*, 2007; Canellas *et al.*, 2009 and Zandonadi *et al.*, 2007). Also, the positive effect of humic acid on the uptake of N, P, Ca, Mg, Fe and Zn was also proved with corn plants (Fortun and Lopez, 1982) and in tomato plants (Adani *et al.*, (1998). Moreover, humates influence the respiration-process, the amount of sugars, amino acids and nitrate accumulated, and make the plants resistant against diseases and viruses (Boehme *et al.*, 2005a). In general, several studies have been conducted on the effect of humic acid on the growth and productivity of cucumbers, Mora *et al.*, (2010) indicate that the beneficial effects of humic substances on shoot development in cucumber could be directly associated with nitrate-related effects on the shoot concentration of several active cytokinins and polyamines (principally putrescine). Also, Halime *et al.*, (2011) showed that cucumber fruit, yield and quality can significantly be improved with soil and foliar HA application. Moreover, all morphological characters parameters including plant height, number of leaves and stems/plant, fresh weights of leaves/plant, as well as yield and its components as well as chemical contents, besides percentage (N, P, K, Ca and Mg) in leaves of cucumber plants showed positive and significant responses with the high concentration of humic acid (3 g/L). El-Nemr *et al.*, (2012) and enhance yield and fruit quality, Mohsen Kazemi (2012).

Bio-fertilizers, help in augmenting the crop productivity through effective mobilization of major plant nutrients like N, P and K and other minor nutrients needed by the crop. Also microorganisms are known to secrete plant growth promoting substances like IAA, GA, cytokinins, vitamins for the improvement of crop growth, yield and for quality produce (Natarjan, 2007;Sreenivasa *et al.*, 2010; Kumar *et al*, 2013 and Mehdizadeh *et al*, 2013). Moreover, the development and use of bio fertilizers is considered as an important alternative for the partial

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or total substitution of synthetic fertilizers, compatible with pesticides, safe to crop and users, eco-friendly and pose no danger to the environment and also minimize the pollution by excessive uses of chemical fertilizer. (Abul Hossain, 2012 and Aghilia *et al.*, 2014). Also, using bio-fertilizer showed higher vegetative growth parameters (plant height; No. of leaves and branches; as well as fresh and dry weight of leaves and stems); yield and its components; physical heads quality (weight, diameter and height); vitamin C; N; P and K in tissues of broccoli leaves and heads (Zaki *et al.*, 2012) and on tomatoes Molla *et al.*,(2012), also chemical properties (T.S.S, Acidity, Ascorbic acid and Carotenoids) increased in pepper plants, Fawzy *et al.*,(2012). Cucumber plants inoculated with Azotobacter plus phosphate dissolving bacteria (PDB) led to significant increases in early and total yield at the half dose of the normal mineral nitrogen, Gharib (2001). Also, Hanna *et al.*, (2005) found that application of chicken manure with biofertilizers (Azotobacter + Azospirillum) significantly increased vegetative growth and early and total yield of cucumber.

El-Shabrawy *et al.* (2010) concluded that soil application of humic acid at 0.5% and inoculation plants with Azotobacter with 90 kg N/fed gave the highest values of yield and NO3-concentration on cucumber fruits which were within the safe levels for human. Moreover, use of biological fertilizers as a single treatment has caused increasing yield and biomass production and improving nutritional status (high P, K, Mg, Fe, Zn, and Mn and low Na accumulation) in cucumber plants inoculation with arbuscular mycorrhizal (Rouphael *et al.*, 2010 and Faranak and Hossein 2012) or combination treatment with chemical fertilizer had significant effect and increases the growth and yield of cucumber, Kamil *et al.*, (2015).

Studies have proved that amino acids can directly or indirectly influence the physiological activities of plant growth and development. Many studies reported that the foliar application of amino acids caused an enhancement in plant growth, fruit yield and its components (ElShabasi *et al.* 2005) on garlic and (Awad *et al.*, 2007) on potato. Also, El-Awadi *et al.*, (2011) concluded that nitrogen fertilizer can be reduced to 65% with sprayed tryptophan amino acid (100mgL-1) to obtain the highest vegetative growth, yield and quality of snap bean plants. Moreover, El Shabasi *et al.* (2005) found that treatments of amino acids significantly improved fruits yield and its components of cucumber. While, Shehata *et al.* (2016) concluded that using microbial inoculants or EM and amino acids gave the highest values of early and total fruits yield and its components and fruit quality of cucumber.

MATERIALS AND METHODS

The field work was carried out at Siwa Research Station of the Desert Research Center, Marsa Matrohe Governorate, during the two consecutive winter seasons of 2015/2016 and 2016/2017. The experiments were conducted to study the effect of soil amendments *i.e.*, Humic acid. and Bio-fertilizers as well as two commercial foliar fertilizer *i.e.*, A 15% and B 20% on growth, yield and chemical composition of cucumber plants, Bahy cv. grown in sandy soil conditions.

Twelve treatments were used which were the combination of four soil amendments *i.e.*, Humic acied at the rate rate of 1kg/fed.; Biofertilizer at the rate of 1kg/fed; mixing between Humic acied and Biofertilizer and control treatment (without application) and three levels of foliar application *i.e.*, Amino acid at the rate of 2ml/L and Biohorm at the rate of 0.5ml/L, beside control spray by tap water.

Bio fertilizers were purchased from the General Authority of Agricultural Funds and Equalization non symbiotic nitrogen fixing bacteria and phosphate solubilizing bacteria).

Amino acid (A 15%) compound contains (w/v) total organic acids plus amino acids 15%, iron (Fe) 2.9%, zinc (Zn) 1.4% and manganese (Mn) 0.7%, free amino acids, proline, hydroxy proline, glycine, alanine, valine, methionine, escaliosin, lysine, cycteine, phenylalanine, serine, glutamic, arginine, histidine, lysine and hystiden.

Biohorm (B 20%) consists of kinetin, citric, ascorbic and fulvic acids, 20% free amino acids, 4% molybdenum and 0.005% CO. Biohorm (produced by Union Company for Agricultural Development).

The physical and chemical soil characteristics of the studied site were determined according to Page *et al*. (1982) and Klute (1986) respectively, as recorded in Table (1). The chemical analysis of irrigation water was carried out using the standard method of Page *et al.*, (1982) as presented in Table (2).

Table 1. Some physical and chemical properties of the experimental soil site.

Soil depth (cm)	Texture class	Soluble anions (me/l)			$pH_{soil\ paste}$	E.C dSm^{-1}	Soluble cations (me/l)			
		HCO_3^-	$SO_4^=$	Cl^-			Ca^{++}	Mg^{++}	Na^+	K^+
0 – 25	Sandy loam	0.75	0.85	4.25	6.7	0.58	1.15	0.45	3.92	0.33

Table 2. Chemical analysis of the irrigation water.

Samples	pH	E.C. dSm^{-1}	Soluble cations (me/l)				Soluble anions (me/l)		
			Ca^{++}	Mg^{++}	Na^+	K^+	HCO_3^-	$SO_4^=$	Cl^-
1st season	7.1	5.54	10.1	13.32	39.4	1.17	9.35	15.1	39.5

Organic manure was added at the rate of 30m³/fed., while calcium super-phosphate (15.5% P2O5) at the rate of 250 kg /fed., magnesium sulphate at the rate of 50 kg /fed., and agricultural sulphur at the rate of 50 kg /fed., were added during land preparation. Nitrogen fertilizer as ammonium sulphate (20.5% N) and potassium sulphate (48% K2O) at the rate of 250 and 150 kg /fed., respectively, nitrogen and potassium quantities were divided and applied with irrigation water during growing seasons started after 30 days from transplanting. Cucumber seedlings were planted in first week of October through the two growing seasons respectively. Transplanting were planted 50 cm apart on one side of the ridge and irrigated with drip irrigation system. The ridges were 150 cm width among drip irrigation lines were 30m long. Soil application *i.e.*, Humic acid and Bio-fertilizers were add to soil before transplanting, while, A 15%and B 20% were applied after 20, 40 and 60 days from transplanting foliar spray, while water was sprayed as a control treatment.

Growth parameters of vegetative growth:

After 90 days from transplanting, three plants of each experimental plot were randomly taken for recording vegetative growth characteristics *i.e.*, (plant height and weight, number leaves and branches /plant and percentage of dry weight of the aerial vegetative parts and root. Leaf area was measured using an automatic leaf area meter AREAMETR (cl-202).Total chlorophyll in plant leaves were measured as SPAD units using Minolta chlorophyll meter (model SPAD 502). Chlorophyll measurements were made using the recently fully expanded leaf and 10 readings were averaged per experimental unit according to A.O.A.C.(1990).

Yield and its components:

- **Early yield:** Fruit of first five harvests (represents fruits with acceptable size) from each treatment were weighted calculated the early yield (kg/m²).The first harvest date at 45 days from transplanting in both seasons and the time between harvests 4 days in both seasons.
- **Total yield:** all harvest times from each treatment were weighted and calculated to calculate average fruits number/plant and total yield (kg/m²) at fruit ripening stage. Sample of three cucumber plants randomly taken from each experimental unit

to determine fruit characteristics, i.e., (average fruit length and weight, also percentage of fruit dry matter was recorded.

Chemical components:

Three samples of cucumber fruits were taken from each subplot and dried in oven at 70ºC until stable weight, then grinded to fine particles and used to determine chemical contents such as minerals content, (K) Potassium were measured using flame photometer method as described by Brown and Lilliland (1964). Total nitrogen was determined using the modified micro Kjeldahl method. Phosphorus was determined using the colorimetric method following the procedure described by Cottenie *et al.* (1982). Total carbohydrates were determined according to A.O.A.C. (1990).

Experimental design and statistical analysis:

The experimental treatments were arranged in split plot design with three replicates, the main plots were assigned for soil amendments, whereas, foliar spray rates were randomly arranged in the sub plots. Statistical analyses of obtained data were analyzed according to Thomas and Hills (1975).

RESULTS AND DISCUSSION

1.Plant Growth Parameters

Growth parameters, *i.e*., plant height and weight, shoot and root dry matter percent, number of leaves and branches/plant, Leaf area and SPAD value were presented in Tables (3 and 4). Obtained results indicated significant positive effect for both soil application and foliar spray of all investigated growth parameters. From the data it could remark the following:

- The highest values in plant height and weight, shoot and root dry matter percent, number of leaves/plant and, Leaf area were recorded with mixing between Humic acied and Biofertilizer treatment followed by Humic acid at rate 1kg/fed., treatment and biofertilizer treatment in both growing seasons. No significant deferences between the first and second treatment in all most growth characters. While, the highest values of No. of branches/plant were recorded with biofertilizer in both seasons and the highest values of Total chlorophyll value were recoded with Humic acid treatment in the first season only, but with mixing treatment in the second season. The results recorded in Tables (3 and 4) are in the same line with those obtained by (Akinremi *et al*. 2000; Serenella *et al*. 2002; Chen *et al.* 2004a and Cimrin and Yilmaz,2005).
- they reported that Humic acid promote plant growth by improving the soil bioavailability of certain nutrients, also it has effect on plant metabolism due to increase catalysis, stimulate respiration, photosynthesis, nucleic acid metabolism, hormonal activity and substances stimulate shoot and root growth. Also, the role of Bio-fertilizers through effective mobilization of major plant nutrients and secrete plant growth promoting substances like IAA, GA, cytokinins, vitamins for the improvement of crop growth of cucumber plant (Gharib, 2001; Hanna *et al.*, 2005; Faranak and Hossein 2012 and Kamil *et al.*, 2015).

Table 3. Effect of soil application and foliar spray on plant height and weight, shoot and root dry matter percent of cucumber plants during 2015/2016 and 2016/2017growing seasons.

Seasons	1st season															
Characters / Treatments	Plant height (cm)				Plant fresh weight (gm.)				Shoot dry matter (%)				Root dry matter (%)			
Foliar spray / Soil application	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄
Humic acid	118.7	118.9	98.0	111.8	664.2	610.5	601.6	625.4	15.4	14.8	14.7	15.0	32.1	33.8	31.4	32.4
Bio fertilizer	105.0	96.5	95.9	99.1	597.0	484.9	448.1	510.0	14.5	15.3	13.8	14.5	34.9	33.9	31.9	33.6
Humic+ Bio F	116.3	122.3	105.1	114.6	689.6	662.3	541.5	631.2	16.0	16.2	13.6	15.2	36.1	35.3	33.7	35.1
control	77.4	74.8	70.4	74.2	489.3	491.6	435.5	472.1	13.4	14.2	13.5	13.7	30.5	31.5	30.8	30.9
X̄	104.4	103.1	92.3		610.0	562.3	506.7		14.8	15.1	13.9		33.4	33.6	32.0	
	2nd season															
Humic acid	124.8	128.0	95.6	116.1	660.4	721.2	636.0	672.5	13.8	14.3	13.1	13.7	35.1	33.2	30.4	32.9
Bio fertilizer	120.1	125.0	93.7	112.9	582.8	621.1	638.8	614.3	14.9	15.0	13.1	14.3	36.4	33.8	31.8	34.0
Humic+ Bio F	141.0	131.5	110.1	127.5	669.3	729.7	639.8	679.6	14.7	15.2	14.4	14.7	35.9	34.4	32.7	34.3
control	106.2	104.7	92.6	101.2	567.1	594.5	552.8	571.4	12.4	13.6	11.7	12.6	27.7	30.7	30.9	29.8
X̄	123.0	122.3	98.0		619.9	666.6	616.8		13.9	14.5	13.1		33.8	33.0	31.5	
L. S. D. (0.05) for:			Sea. 1	Sea. 2			Sea. 1	Sea. 2			Sea. 1	Sea. 2			Sea. 1	Sea. 2
Soil application			11.55	9.94			75.10	77.99			0.87	0.83			1.28	1.82
foliar spray			4.89	6.15			63.80	42.18			0.74	0.88			NS	1.77
Interaction			NS	NS			NS	NS			NS	NS			NS	NS

Table 4. Effect of soil application and foliar spray on number of leaves and branches/plant, Leaf area (cm²) and Total chlorophyll value of cucumber plants during 2015/2016 and 2016/2017growing seasons.

Seasons	1st season															
Characters / Treatments	No. of branches/plant				Number of leaves/plant				Leaf area (cm²)				Total chlorophyll			
Foliar spray / Soil application	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄
Humic acid	6.10	6.00	4.33	5.48	24.7	24.3	22.0	23.7	110.1	145.5	91.4	115.7	45.7	42.7	43.7	44.0
Bio fertilizer	6.00	7.67	5.00	6.22	24.7	23.3	19.3	22.4	149.6	98.3	107.8	118.6	42.9	45.1	41.5	43.2
Humic+ Bio F	6.67	6.67	5.00	6.11	28.0	23.7	20.3	24.0	104.1	127.0	152.3	127.8	42.6	43.4	44.5	43.5
control	5.33	4.33	4.00	4.56	20.7	20.0	18.7	19.8	84.3	98.8	113.1	98.7	41.0	41.9	40.4	41.1
X̄	6.03	6.17	4.58		24.5	22.8	20.1		112.0	117.4	116.2		43.1	43.3	42.5	
	2nd season															
Humic acid	7.00	6.67	5.00	6.22	22.7	23.3	22.7	22.9	115.0	109.5	121.6	115.4	44.2	44.8	43.8	44.3
Bio fertilizer	7.67	7.67	5.33	6.89	26.6	21.7	23.1	23.8	131.4	115.0	106.8	117.8	42.4	45.4	41.4	43.1
Humic+ Bio F	8.33	7.00	5.00	6.78	31.0	24.3	23.3	26.2	143.0	132.1	122.4	132.5	44.5	43.5	45.1	44.4
control	6.33	5.00	4.33	5.22	18.7	20.7	20.3	19.9	109.9	116.5	107.9	111.5	40.0	42.3	42.4	41.6
X̄	7.33	6.58	4.92		24.7	22.5	22.4		124.9	118.3	114.7		42.8	44.0	43.2	
L. S. D. (0.05) for:			Sea. 1	Sea. 2			Sea. 1	Sea. 2			Sea. 1	Sea. 2			Sea. 1	Sea. 2
Soil application			0.590	0.922			2.45	2.01			6.90	4.82			1.33	1.21
foliar spray			0.997	0.699			1.69	1.46			4.34	7.37			NS	0.86
Interaction			NS	NS			NS	2.93			8.68	14.7			2.56	1.71

- Foliar spray by A 15%at the rate of 2ml/L showed significant increase in plant height and No. of leaves/plant in both seasons and in plant fresh weight in the first season also the highest values in root dry matter (%), No. of branches/plant and leaf area in the

second season. These results in the same line with those reported by ElShabasi *et al.*, (2005) they found that treatments of amino acids significantly improved growth parameters of cucumber. On the other hand, B 20% at the rate of 0.5ml/L showed the highest values in shoot dry matter percent and total chlorophyll value in both gowning seasons, also highest values of root dry matter (%), No. of branches/plant and leaves area in the in the first season and in plant fresh weight in second season only.

- The interaction among study treatments showed that mixing treatment (Humic acid + biofrtelizer) with A 15%spray recorded the significant and highest values in No. of leaves and leaves area characters in the second season only. Also, mixing treatment with control (without foliar spray) recorded the high values in leaves area followed by biofertilizre treatment and A 15%spray in the first season. While, humic acid treatment with A 15%spray and biofertilizer treatment with B 20% spray recorded the highest total chlorophyll values in the first and second seasons, respectively.

Yield and its components:

Results obtained concerned with number of fruits/plant, fruit length and weight; dry matter percentage; plant yield, early and total yield for all treatments were presented in Tables (5&6). From the data, the following could be concluded

- It was clear that soil application with mixing treatment (Humic acid + biofrtelizer) enhanced and showed significant increase in number of fruits/plant, fruit length and weight; plant yield, early and total yield followed by humic acid treatment. No significant deference occurred among treatments in all most yield and its components in both growing seasons. The results recorded in Tables (5&6) are in the same line with several studies have been conducted on the effect of humic acid on yield and productivity of cucumbers (Halime *et al.*, 2011; El-Nemr *et al.*, 2012 and Mohsen Kazemi, 2012), they indicate that the beneficial effects of humic substances on development in cucumber could be directly associated with the shoot concentration of several active cytokinins and polyamines to stimulate respiration, photosynthesis which are enhance growth and positive reflected on fruit quality, early and total yield. Also, biofertilizer had major role in increase cucumber yield and its components (Gharib, 2001; Hanna *et al*. 2005; Faranak and Hossein 2012 and Kamil *et al.*, 2015).

Table 5. Effect of soil application and foliar spray on number of fruits /plant, fruit length; weight and dry matter percentage of cucumber plants during 2015/2016 and 2016/2017growing seasons.

Seasons	1st season															
Characters / Treatments	Number of fruits/plant				Fruit length (cm)				Fruit weight (gm.)				Fruit dry matter (%)			
Foliar spray / Soil application	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄
Humic acid	16.3	12.3	13.5	14.0	14.0	14.6	13.9	14.2	97.0	86.0	70.2	84.4	5.48	5.28	4.62	5.13
Bio fertilizer	16.4	12.8	14.6	14.6	14.3	14.2	14.4	14.3	85.5	76.0	84.3	81.9	5.12	5.31	4.50	4.97
Humic+ Bio F	16.2	16.3	13.2	15.3	14.9	15.1	14.9	15.0	94.5	87.5	77.4	86.5	5.43	5.90	4.27	5.20
control	14.0	14.6	11.3	13.3	14.6	14.4	14.1	14.3	94.5	62.3	69.9	75.6	5.17	4.98	4.37	4.84
X̄	15.7	14.0	13.1		14.4	14.6	14.3		92.9	77.9	75.5		5.30	5.37	4.44	
							2nd season									
Humic acid	17.1	14.1	12.5	14.6	15.16	14.66	14.17	14.66	100.2	99.8	97.6	99.2	6.06	5.86	5.27	5.73
Bio fertilizer	15.4	15.0	13.3	14.6	14.92	14.73	13.86	14.51	120.3	84.4	91.7	98.8	5.50	5.70	5.84	5.68
Humic+ Bio F	18.1	15.9	14.2	16.1	15.92	15.96	15.42	15.77	119.4	95.4	93.9	102.9	5.70	6.29	5.80	5.93
control	13.5	14.8	14.5	14.3	13.62	14.52	13.48	13.88	95.2	92.3	97.6	95.0	5.25	6.09	4.89	5.41
X̄	16.0	15.0	13.6		14.91	14.97	14.23		108.8	93.0	95.2		5.62	5.98	5.45	
L. S. D. (0.05) for:			Sea. 1	Sea. 2			Sea. 1	Sea. 2			Sea. 1	Sea. 2			Sea. 1	Sea. 2
Soil application			1.30	1.14			0.53	0.79			5.08	4.96			NS	NS
foliar spray			0.80	0.77			NS	NS			4.86	5.46			0.41	0.36
Interaction			1.61	1.54			NS	NS			9.71	10.9			NS	NS

Table 6. Effect of soil application and foliar spray on plant yield, early and total yield of cucumber fruit during 2015/2016 and 2016/2017growing seasons.

Seasons	1st season											
Characters / Treatments	Plant yield (Kg.)				Early yield (%)				Total yield (ton/fed.)			
Foliar spray / Soil application	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄	A 15%	B 20%	Cont.	X̄
Humic acid	1.58	1.06	0.95	1.19	29.7	25.9	24.0	26.5	8.94	6.16	6.26	7.12
Bio fertilizer	1.40	0.97	1.23	1.20	24.9	27.1	23.0	25.0	7.89	5.45	6.98	6.77
Humic+ Bio F	1.54	1.43	1.02	1.33	32.3	28.4	24.6	28.5	8.60	7.87	5.73	7.40
control	1.32	0.91	0.79	1.01	25.0	24.6	20.2	23.2	7.50	5.31	4.55	5.78
X̄	1.46	1.09	1.00		28.0	26.5	22.9		8.23	6.19	5.88	
						2nd season						
Humic acid	1.71	1.41	1.22	1.45	32.3	30.4	26.0	29.6	9.33	7.90	6.77	8.00
Bio fertilizer	1.85	1.27	1.22	1.45	28.0	26.1	22.6	25.5	9.97	6.93	6.82	7.91
Humic+ Bio F	2.16	1.52	1.34	1.67	34.3	31.1	25.2	30.2	11.55	8.58	7.48	9.20
control	1.29	1.36	1.41	1.36	25.1	23.8	19.9	22.9	7.68	7.64	7.91	7.74
X̄	1.75	1.39	1.30		29.9	27.8	23.4		9.63	7.76	7.24	
L. S. D. (0.05) for:			Sea. 1	Sea. 2			Sea. 1	Sea. 2			Sea. 1	Sea. 2
Soil application			0.118	0.143			1.87	2.22			0.78	0.85
foliar spray			0.106	0.104			2.46	1.92			0.60	0.70
Interaction			0.213	0.208			NS	NS			1.20	1.40

- Foliar spray by A 15%recorded the highest values in number of fruits/plant; fruit weight; plant yield, early and total yield in both growing season. Also, B 20% spray treatment showed high values in fruit length and dry weight percentage followed by A 15%treatment without significant deference in both seasons. These results agreed with those reported by (ElShabasi *et al.*, 2005 and El Shabasi *et al*. 2005) they found that the foliar application of amino acids caused significantly improve and enhancement in fruit yield and its components of cucumber.

- The interaction among study treatments showed that the combination between humic acid as a soil application and A 15%as a foliar in No. of fruits/plant in both seasons and in fruit weight, plant yield and total yield in first season only. But, mixing (Humic acid + biofrtelizer) with A 15%treatment surpassed significantly in fruit weight, plant yield and total yield in second season, the results agreed with those reported by Shehata *et al.,* (2016).

Chemical components:

Data recorded in fig. (1) Represented the chemical constituents of cucumber plant. Results showed significant effect of the studied factors, in the both growing season.

- mixing (Humic acid + biofrtelizer) treatment showed significant increase in N; P; K and total carbohydrate in both seasons except biofertilizer treatment had the highest values in K and total carbohydrate in second season only. The positive effect of humic acid on the uptake of N, P, Ca, Mg, Fe and Zn was proved with corn plants (Fortun and Lopez, 1982) and in tomato plants (Adani *et al.*, (1998), also in cucumber plants, El-Nemr *et al.*, (2012). Moreover, use of biological fertilizers as a single treatment has caused increase in nutritional status (high P, K, Mg, Fe, Zn, and Mn and low Na accumulation) in cucumber plants which were inoculated with arbuscular mycorrhizal. (Rouphael *et al.*, 2010 and Faranak and Hossein 2012) obtained results in the same line with those have been reported.

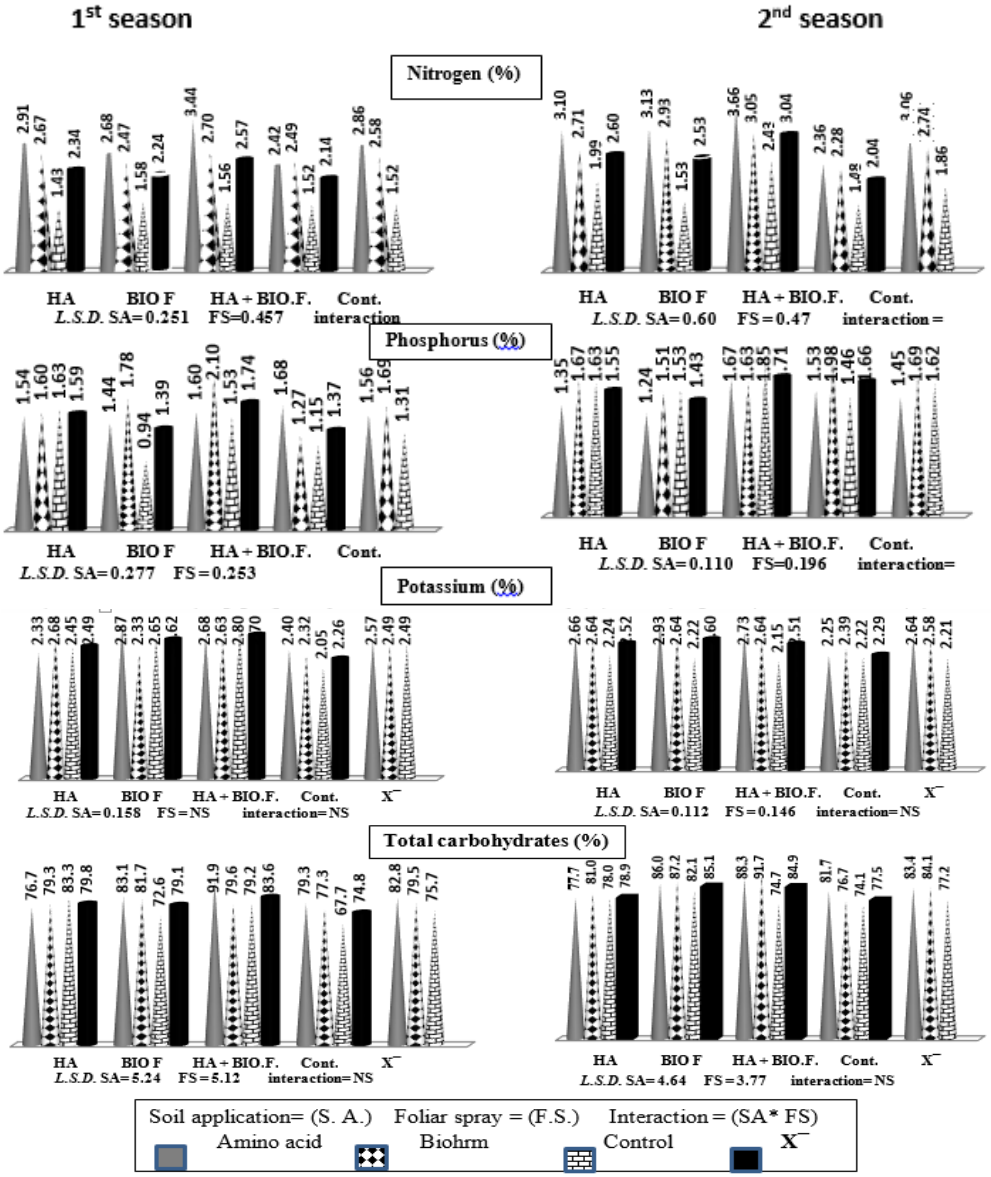

Fig. 1. Effect of soil application and foliar spray on N, P, K and total carbohydrates of cucumber fruit during 2015/2016 and 2016/2017growing seasons.

- Foliar spray by A 15%recorded the highest values in N (%) followed by B 20% spray treatment in both seasons also, A 15%recorded the highest values in total carbohydrate in the first season and in K (%) in the second season. Moreover, B 20% spray showed the highest values in P (%) in both seasons. Foliar spray by A 15%improved chemical contents of cucumber plants (ElShabasi *et al.,* 2005 and Shehata *et al.,* 2016).

- The question of great importance is how far the different investigated parameters are correlated with each other. It can be seen from fig (2) that number of fruits/plant were significantly correlated with number of leaves/plant. Correlation coefficients (r) were 0.563 and 0. 316 in the first and second seasons, respectively. Corresponding coefficients of determination (r^2) were 0.317and 0.406, indicating that 31.7 to 40.6% of the variation in number of fruits/plant was related to the number of

leaves/plant. On the other hand, the regression coefficients (b) were 0.36 and 0.316 in the first and second seasons, respectively. These indicated that for each increase of one leaf/plant, number of fruits/plant correspondingly increased by 0.36 and 0.316 fruit Similarly, highly significant positive correlations were existed between total yield (ton/fed) and number of fruit/plant (Figure 2). A linear regression showed that for each increase of one fruit/plant, total yield correspondingly increased by 0.69 and 0.78 ton/fed in the first and second seasons, respectively.

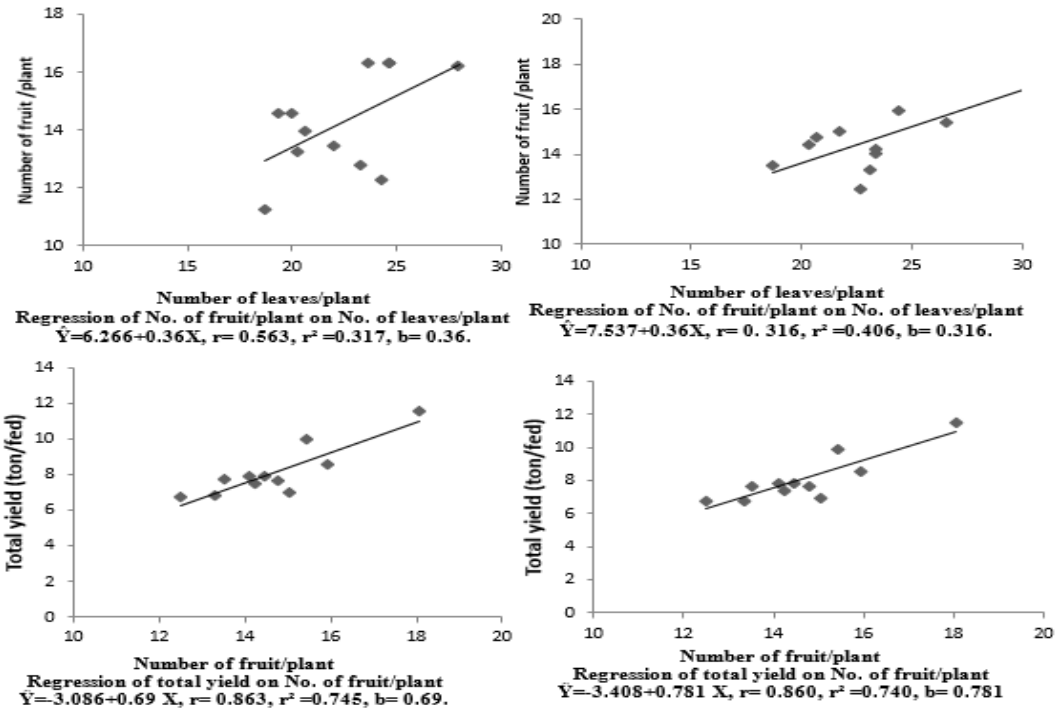

Fig. 2. Linear regression; correlation coefficients (r), coefficients of determination (r^2) and regression coefficients (b) of total yield (ton/fed) on number fruit/plant, and regression of on number fruit/plant on on number leaves/plant

REFERENCES

Abul Hossain, M.; M. M. Haque; M. A. Haque and G. N. M. Ilias. (2012). Trichoderma-Enriched Biofertilizer Enhances Production and Nutritional Quality of Tomato (*Lycopersicon esculentum* Mill.) and Minimizes NPK Fertilizer Use. Agric Res., 1(3):265–272.

Adani, F., P. Genevini, P. Zaccheo and G. Zocchi, (1998). The effect of commercial humic acid on tomato plant growth and mineral nutrition. J. Plant Nutrition, 21(3): 561-575.

Aghilia, F.; Jansab, J.; Khoshgoftarmaneshc, A. H.; Afyunic, M.; Schulind, R.; Frossarda, E. and H. A. Gampera, (2014). Wheat plants invest more in mycorrhizae and receive more benefits from them under adverse than favorable soil conditions. Appl. Soil Ecology. 84(1):93-111.

Awad, El-M.M., A.M. Abd El-Hameed and Z.S. Shall, (2007). Effect of glycine, lysine and nitrogen fertilizer rates on growth, yield and chemical composition of potato. J. Agric. Sci. Mansoura Univ., 32(10): 8541 - 8551.

A.O.A.C. (1990). Official Methods of Analysis. Twelfth ed. Published by the association of official analytical chemists. Benjamin. Frank line station, Washington. Dc.

Baigorri R, Fuentes M, Gonza´lez-Gaitano G and J.Garcı´a-Mina (2007). Analysis of molecular aggregation in humic substances in solution. Colloid Surf. 6: 302:301.

Biondi, F.A., Figholia, A., Indiati, R. and C. Izza, (1994).Effects of fertilization with humic acids on soil and plant metabolism: a multidisciplinary approach. NoteIII: phosphorus dynamics and behaviour of some plant enzymatic activities. In Humic Substances in the Global Environment and Implications on Human Health, ed. Senesi N & Miano TM. Elsevier, New York, pp. 239-244.

Boehme, M., J. Schevtschenko and I. Pinker, 2005a. Iron Supply of Cucumbers in Substrate Culture with Humate. Acta Hort. 697 ISHS, 41(1): 329-335.

Brown, J.D. and O. Lilliland. (1964). Rapid determination of potassium and sodium in plant material and soil extracts by flame photometer. Proc. Amer.Soc. Hort. Sci., 48: 341-346.

Canellas, L.P., Piccolo, A., Dobbss, L.B., Spaccini, R., Olivares, F.L., Zandonadi, D.B., and A.R.,anha, (2009). Chemical composition and bioactivity properties of size-fractions separated from a vermicompost humic acid. Chemosphere 78, 457–466

Chen Y, Clapp C. and H. Magen (2004a). Mechanism of plant growth stimulation by humic substances: The role of oregano-iron complexes. Soil Sci Plant Nutr;50:1089–95.

Chen Y, De Nobili M and T. Aviad (2004b). Stimulatory effects of humic substances on plant growth. Soil Organic Matter in Sustainable Agriculture. Boca Raton, Florida: CRC Press; p. 103–129

Cottenie, A.; Verloo M.; Kickens L.; Velghe G. and Camerlynck, R. (1982). Chemical analysis of plants and soils. Laboratory of Analytical and Agrochemistry. State Univ., Ghent Belgium, pp: 63.

El-Awadi, M. E.; A. M. El-Bassiony; Z. F. Fawzy and M. A. El-Nemr. (2011). Response of Snap Bean (*Phaseolus vulgaris* L) Plants to Nitrogen Fertilizer and Foliar Application with Methionine and Tryptophan. Nature and Science;9(5):87-94]. (ISSN: 1545-0740).

El-Nemr, M.A., M. El-Desuki, A.M. El-Bassiony and Z.F. Fawzy.(2012). Response of Growth and Yield of Cucumber Plants (Cucumis sativus L.) to Different Foliar Applications of Humic Acid and Bio-stimulators. Australian Journal of Basic and Applied Sciences, 6(3): 630-637.

El-Shabasi, M.S., S.M. Mohamed and S.A. Mahfouz, (2005). Effect of foliar spray with amino acids on growth, yield and chemical composition of garlic plants. The 6th Arabian Conf. for Hort. Ismailia, Egypt.

El-Shabrawy, R. A.*; A.Y. Ramadan* and Sh. M. El-Kady (2010). Use OF Humic Acid and some Biofertilizers to Reduce Nitrogen Rates on cucumber (*cucumis sativus* L.) in relation to vegetative growth, yield and chemical composition. J. Plant Production, Mansoura University, 1(8): 1041 - 1051

Faranak Moshabaki Isfahani and Hossein Besharati. (2012). Effect of biofertilizers on yield and yield components of cucumber Journal of Biology and Earth Sciences. 2,(2). 83-92

Fawzy Z. F., A. M. El-Bassiony, L. Yunsheng, O. Zhu and A.A., Ghoname (2012). Effect of Mineral, Organic and Bio-N Fertilizers on Growth, Yield and Fruit Quality of Sweet Pepper Journal of Applied Sciences Research, 8(8): 3921-3933.

Fortun, C. and C. Lopez, (1982). Influence of humic acid on the mineral nutrition and the development of the maize roots, cultivated in normal nutritive solutions and lacking of Fe and Mn. Anades-de Edafologia yagrobiologia (Spain). Jan-Feb/ 1982, 41(1-2): 335-349.

Gharib, M.G. (2001). Response of two cucumber cultivars to biofertilization under plastic house condition. M.Sc. Thesis, Fac. of Agric. Cairo Univ. 183 pp.

Halime O.U., 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.

Hanna, M.M.; S.A. Kabeel and F.M.A. Darwish (2005): Effect of organic and biofertilizers on growth yield and fruit quality of cucumber grown under clear polyethylene low tunnels. J. Agric. Sci., Mansoura Univ., 30(5): 2827-2841.

Kamil S. S.; S. A. Ahmed; I. A. Hassan and P. H. Ahmed. (2015). Effect of Bio-fertilizer and Chemical fertilizer on Growth and Yield in Cucumber in Green House condition. Pakistan Journal of Biological Sciences, 18(3):129-134.

Klute, A. J. (1986). "Methods of Soil Analysis". No. (9), Part 1 - Physical and Mineralogical Methods. Am. Soc., Agron., Inc. Soil. Sci., Mad., Wisc., U.S.A.

Kumar. J. Ajay, K.R. Sreeramulu and G. Kushala. (2013) Effect of microbial inoculants on the yield of beet-root (*Beta vulgaris*), Asian J. of Bio Sci.,8, (6):10.

Mehdizadeh, M., E. I. Darbandi, H. Naseri-Rad, and A. Tobeh (2013). Growth and yield of tomato (*Lycopersicon esculentum* Mill.) as influenced by different organic fertilizers. International Journal of Agronomy and Plant Production. 4(4):734-738.

Mohsen Kazemi. (2012). Effect of Foliar Application of Humic Acid and Potassium Nitrate on Cucumber Growth. Bull. Env. Pharmacol. Life Sci., 2 (11): 03-06.

Molla, A. ; M. M. Haque; M. A. Haque and G. N. M. Ilias (2012).Use Trichoderma-Enriched Bio fertilizer Enhances Production and Nutritional Quality of Tomato (*Lycopersicon esculentum* Mill.) and Minimizes NPK Fertilizer Use Agric. Res., 1(3):265–272.

Mora Vero´ nica ; Eva Bacaicoa ; Angel-Maria Zamarren˜o ; Elena Aguirre ; Maria Garnica ; Marta Fuentes ; Jose´-Maria and Garcı´a-Mina. (2010). Action of humic acid on promotion of cucumber shoot growth involves nitrate-related changes associated with the root-to-shoot distribution of cytokinins, polyamines and mineral nutrients. Journal of Plant Physiology, 167. 633–642.

Page, A. L., Miller R. H. and D. R. Keeney. (1982). "Methods of soil analysis". No. (9), Part 2. Chemical and Microbiological Properties. Am. Soc., Agron., Inc. Soil. Sci., Mad., Wisc., U.S.A.

Rouphael Y.; M. Cardarelli: G. Colla and E. Di Mattia. (2010). Enhancement of alkalinity tolerance in two cucumber genotypes inoculated with an arbuscular mycorrhizal biofertilizer containing Glomus intraradices Biol Fertil Soils, 46:499 509.

Schmidt, W., Santi, S., Pinton, R., Varanini, Z., (2007). Water-extractable humic substances alter root development and epidermal cell pattern in Arabidopsis. Plant Soil, 300: 259–267.

Serenella N, Pizzeghelloa DA, Muscolob N and A. Vianello (2002). Physiological effects of humic substances on higher plants. Soil Biol. Biochem., 34: 1527-1536.

Shehata, S. A.; H. A. Hassan; A. A. Tawfik and M. F. Farag. (2016). Improving The Productivity and Quality of The Cucumber Crop Grown Under Greenhouse Conditions Using Some Stimulants and Spraying Amino Acids. J. Plant Production, Mansoura Univ., 7 (4): 385 -392.

Sreenivasa M.N, M.N. Nagaraj, and S.N. Bhat. (2010). Beejamruth: A source for beneficial bacteria. Karnataka J. Agric. Sci., 17(3):72-77.

Thomas, M. L. and F. G. Hills.(1975). Statistical Methods In Agric. Research, Univ. of California, Davis 95616 2nd printing,. 67-74.

Zaki, M.F., A.S. Tantawy, S.A. Saleh and Y. I. Helmy. (2012). Effect of Bio-fertilization and different levels of nitrogen sources on growth, yield components and head quality of two Broccoli cultivars. Journal of Applied Sciences Research, 8(8): 3943-3960.

Zandonadi, D.B., Santos, M.P., Dobbss, L.B., Olivares, F.L., Canellas, L.P., Binzel, M.L., Okorokova, A.L. and A.R. anha, (2010). Nitric oxide mediates humic acidsinduced root development and plasma membrane H+-ATPase activation. Planta, 231: 1025–1036.

بعض الممارسات الزراعية لتحسين نمو وانتاجية الخيار خلال الموسم الشتوى فى الحقول المكشوفة

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قسم الإنتاج النباتى – مركز بحوث الصحراء – المطريه – القاهرة

اجريت الدراسة بمحطة مركز بحوث الصحراء بواحة سيوه محافظة مرسى مطروح خلال موسمين متتاليين 2015/2016 و 2016/2017 . واجريت التجربة لدراسة تأثير اضافة حامض الهيوميك والاسمدة الحيوية والخلط بينهما كأضافة ارضية والرش بمركب الاحماض الامينية والبيوهورم على نمو وانتاجية والتركيب الكيميائى لنبات الخيار. اوضحت النتائج الدراسة ان اعلى القيم فى صفات طول ووزن النبات ، نسبة المادة الجافة فى العرش والجذور، عدد الاوراق /النبات ومساحة الورقة ، عدد الثمار/ النبات ، طول ووزن الثمرة، محصول النبات، المحصول الكلى والمبكر والتركيب الكيميائى سجلت مع معاملة الخلط بين حامض الهيوميك والتسميد الحيوى، تبعها معاملة اضافة حامض الهيوميك منفردا ولم يسجل فرق معنوى بين المعاملتين فى معظم الصفات فى كلا الموسمين . الا ان معاملة اضافة التسميد الحيوى منفردة سجلت اعلى القيم فى عدد الافرع على النبات فى كلا الموسمين ونسبة البوتاسيوم والسكريات الكلية فى الموسم الثانى فقط. معاملت الرش الورقى بالاحماض الامينية بمعدل 2ملى/لتر تفوقت فى صفات طول النبات ، عدد الاوراق ،عدد الثمار، وزن الثمره ، محصول النبات ، المحصول المبكروالكلى ونسبة النتروجين فى كلا الموسمين. فى حين تفوقت معاملة الرش بمركب البيوهورم نسبة المادة الجافة فى الاوراق والثمار؛ و العناصر الصلبة الذائبه والفسفور الكلى فى كلا الموسمين اظهرت الدراسة ارتباط ايجابى بين صفات الدراسة حيث اعطى معامل الانحدار (b) مع كل زيادة مقدارها ورقه واحده على النبات بزيد عدد الثمار بمعدل 0.36 و 0.31 ثمره/النبات ومع كل زيادة مقدارها ثمره /النبات يزيد المحصول الكلى بمعدل 0.69 و 0.78 طن/فدان فى الموسم الاول والثانى على التوالى .