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EFFECT OF SOME STIMULANTS AND SPRAYING AMINO ACIDS ON GROWTH AND CHEMICAL COMPOSITION OF CUCUMBER PLANTS GROWN UNDER GREENHOUSE CONDITIONS

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ABSTRACT

The current study was conducted in a greenhouse belongs to the Faculty of Agriculture Farm, Cairo University during 2012/3013 and 2014/2015 early autumn seasons to study the effect of amino acids as foliar application and using four stimulants; *viz.*, microbial inoculants, mixture of nitrogen fixing bacteria (*Azotobacter* sp), phosphate dissolving bacteria (*Bacillus megaterium*) and potassium dissolving bacteria (*Bacillus circulans*), humic acid, effective microorganisms (EM) and yeast strains (*Saccharomyces cerevisiae,* 110) as soil fertilizer on vegetative growth characters and chemical composition of cucumber cv. Safa 62. The experiment treatments which were the combinations between amino acids (0 and 2 g/l) and four stimulants were arranged in a factorial experiment with three replicates in addition to sprayed with tap water (control). Results indicated that spraying cucumber plants with amino acids affected significantly plant height, number of leaves, average leaf area and K content in leaves while, chlorophyll content and dry weight of leaves were not significantly affected in both seasons. However, N content in first season only and P content in second season only in leaves were significantly affected. Differences of P content in first season only and N content in second season only in leaves were insignificant. Stimulants increased plant height, number of leaves/plant, average leaf area, chlorophyll content in leaves, dry weight of leaves and the content of N, P, and K in leaves comparing with control while, the lowest values were recorded. The microbial inoculants and EM gave the highest plant height, number of leaves/plant, average leaf area, chlorophyll content in leaves, dry weight of leaves and the content of N, P, and K in leaves comparing with the other bio-stimulants. Foliar application of amino acids combined with microbial inoculants and also amino acids combined with EM gave the highest values of all vegetative growth characters and chemical composition in leaves in this study comparing with other interaction treatments.

Key words: Nitrogen, fixing bacteria, humic acid, yeast, effective microorganisms (EM), growth, cucumber, greenhouse conditions.

INTRODUCTION

Amino acids are fundamental ingredients in the process of protein synthesis, formation of plant tissue and chlorophyll synthesis. El-Shabasi *et al*. (2005) found that amino acids treatments significantly improved plant growth and its components. In addition, stimulants improved higher pigments levels in leaves of vegetables compared to non-treated plants. In the same respect, stimulants were able to promote vegetative growth, mineral nutrient uptake and improve the productivity of many plants (Fayad, 2005; Fathy *et al*., 2008; Hassan *et al*., 2008; Sarhan *et al*., 2011; Hassan *et al*., 2013; Hernández *et al*., 2013; Shafeek *et al*., 2014). Soil bacteria have been used in crop production for decades. The main functions of these bacteria (Davison, 1988) are to (1) supply nutrients to crops, (2) stimulate plant growth, *e.g.,*

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through the production of plant hormones, (3) control or inhibit the activity of plant pathogens, (4) improve soil structure and (5) bioaccumulation or microbial leaching of inorganic (Brierley, 1985). Free-living soil bacteria beneficial to plant growth are usually referred to as plant growth promoting rhizobacteria (PGPR) capable of promoting plant growth by colonizing the plant root (Kloepper and Schroth, 1978; Kloepper *et al*., 1989; Cleyet *et al*., 2001). PGPR use one or more of direct or indirect mechanisms of action to improve plant growth and health. These mechanisms can probably be active simultaneously or sequentially at different stages of plant growth. P-solubilization, biological nitrogen fixation, improvement of other plant nutrients uptake and phytohormone production like indole-3- acetic acid are some examples of mechanisms that directly influence plant growth. Han *et al*. (2006) evaluated the potential of phosphate solubilizing bacteria (PSB) *Bacillus megaterium* var. *phosphaticum* and potassium solubilizing bacteria (KSB) *Bacillus mucilaginous* inoculated in nutrient limited soil planted with pepper and cucumber. The results showed that combined together, rock materials and both bacterial strains consistently increased further mineral availability, uptake and plant growth of pepper and cucumber, suggesting its potential use as fertilizer. Foliar sprays of these substances also promoted growth in a number of plant species (Brownell *et al*., 1987; Yildirim, 2007; Karakurt *et al*., 2009; Halime *et al*., 2011).

Likewise, humic substances have been shown to stimulate shoot and root growth and nutrient uptake of vegetable crops (Tattini *et al*., 1990; Padem *et al*., 1997; Akinremi *et al*., 2000; Cimrin and Yilmaz, 2005). Zaky *et al*. (2006) found that the number of shoots/plant and average leaf area were increased by application of humic acid as a foliar fertilizer at a rate of 1 g/l. Different reports indicated that humic acid treatments improved growth of various plants including cucumber, tomato, eggplant and pepper (Karakurt *et al*., 2009; Arancon *et al*., 2006; Yildirim, 2007). Mahmoud *et al* (2009) showed that cucumber plants sprayed with humic acid (0, 1, and 2 g/l) or seaweed extract (0, 2, and 3 ml/l) led to positive significant differences in leaf area and chlorophyll content as compared to untreated plants. Also, it has latory effect on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (Swelam, 2012).

Yeast is a natural bio-substance suggested to have stimulating, nutritional and protective functions when used on vegetables. Many studies indicated that yeast is one of the richest sources of high quality protein, especially the essential amino acids like lysine and tryptophan, essential minerals as calcium and trace elements as cobalt and iron. Yeast is the best source of the B-complex vitamins and a valuable source of bio-constituents especially cytokinins (Amer, 2004). Also Mahmoud *et al*. (2013) found that yeast extracts improved pea vegetative growth with using the highest level of yeast extract (2%). Foliar application of yeast increased growth of lettuce (Fawzy, 2007), eggplant (El-Tohamy *et al*., 2008) and cucumber (Shehata *et al*., 2012).

The main objective of this investigation was to evaluate the impact of amino acids as foliar application and using some stimulants; *viz*., microbial inoculants, mixture of nitrogen fixing bacteria (*Azotobacter* sp.), phosphate dissolving bacteria (*Bacillus megaterium*) and potassium dissolving bacteria (*Bacillus circulans*), humic acid, effective microorganisms (EM) and yeast strains (*Saccharomyces cerevisiae* 110) on vegetative growth and chemical composition of cucumber under greenhouse.

MATERIALS AND METHODS

Two experiments were carried out in plastic greenhouses (8.5 × 40 m, 2.7 height) at Faculty of Agriculture Farm, Cairo University during 2012/ 3013 and 2014/2015 early autumn seasons. The objectives were to investigate the influence of amino acids as foliar application and some bio-stimulants; *i.e.,* microbial inoculants, humic acid, effective microorganisms (EM) and yeast strains (*Saccharomyces cerevisiae,* 110) as soil application on the vegetative growth and chemical composition of cucumber (*Cucumis sativus* L.) cv. Safa 62 in organic fertilizer as natural rocks; phosphate and potassium rock as well as compost under sandy culture condition whereas the soil has been replaced with sand because of soil diseases. The sand culture were performed randomly collected at five samples and subjected to EC 1.2 and 1.8 (dS/m) and pH 7.84 and 5.95 at two seasons, respectively.

The plastic greenhouse was 40 m long and 8.5 m wide (340 m^2) and divided into five terraces, each 1 m wide and 40 m long. Seedlings were planted on two sides of each terrace and 50 cm apart.

Seeds of cucumber were sown in the nursery on 13th September and September 7th in both seasons, respectively and the seedlings were transplanted in the greenhouse on 28th and 22nd of September in both seasons, respectively each plot was 5 m^2 (5 m long and 1m width) with 20 plants. All treatments were distributed at random. All experimental units received identical amounts of nitrogen (22 kg N/100 m^2) provided from compost (1.49 and 1.34% N in the first and second seasons, respectively), phosphate (9 kg P_2O_5/100m^2) provided from the natural rock phosphate (20 % P_2O_5) and potassium (25 kg K_2O/100 m^2) provided from the natural rock potassium (10 % K_2O) banded on rows during soil preparation before planting. The drip irrigation was used until the end of the season. All practices were carried out as commonly followed as recommended.

This experiment included ten treatments which were the combinations between amino acids (0 and 2 g/l) and some stimulants. The treatments were arranged in a factorial experiment with three replicates.

Amino acids were arranged in the main plots while, stimulants were randomly distributed in sub plots.

The treatments were as follows:

Foliar Spray with Amino Acids

a. Amino acids at 2 g/l.

b. Spray with tap water (control).

Amino acids were sprayed with a rate of 2 g/l at each time (once every 7 days) started from transplanting until end of the season.

stimulants Treatments

a. Microbial inoculants (7.5 g/100m^2).

b. Humic substance (250g/100 m^2).

c. Effective microorganisms (EM) (1.5 l/100 m^2).

d. Yeast (3.6 l /100 m^2).

e. Spray with tap water (control) without stimulants.

Regarding the use of stimulants (microbial inoculants, humic substance, EM and yeast), they were applied to the soil around plants three times (once every 15 days) started from transplanting.

Microbial inoculants

Mixed inocula from nitrogen fixing bacteria (*Azotobacter* sp.), phosphate dissolving bacteria (*Bacillus megaterium*) and potassium dissolving bacteria (*Bacillus circulans*) by the rate of 7.5 g/100 m^2, each inoculum has 10^8/g bacterial cells obtained from Agricultural Research Center, Central Lab of Organic Agriculture; ARC, Egypt.

Humic substance

The composition of humic acid (K- humate content of 85.0% humic acids) was applied around plants with a rate (250 g/100 m^2).

The effective microorganisms (EM)

Stock solution has been produced and available at the Ministry of Agriculture, Egypt. The EM is composed of about 80 different beneficial microorganism species (Hu and Qi, 2013).

Among the different microorganism species contained in the EM are the lactic acid bacteria, photosynthetic bacteria, yeasts, and fungi with a rate of (1.5 l / 100 m^2).

Yeast

Saccharomyces cerevisiae was applied around plants with a rate of 3.6 l /100 m^2 three times (once every 15 days) started from transplanting. Yeast was obtained from Biofertilization Production Unit; Soils, Water and Environment Research Institute; ARC; Egypt.

Data Recorded

Vegetative growth and chlorophyll

Random samples consisted of five plants from each plot were taken at 60 days after transplanting, and the following data were recorded: Plant height, number of leaves/plant, aaverage leaf area of the 5th leaf was determined using the LI-3100 area meter (LI- COR. Inc.

Lincoln, Nebraska, USA) and Leaf chlorophyll content (SPAD) was determined using the fifth expanded upper leaf of five plants per plot. A digital chlorophyll meter, model Minolta chlorophyll meter SPAD-502, manufactured by Minolta Company was used.

Chemical Composition

Random samples consisted of five plants from each plot were taken at 90 days after transplanting and the following data were recorded:

Percentage of dry matter of leaves

Dry matter percentage was determined in leaves as 100 g fresh weight from each experimental unit was weighed and oven-dried at 105°C to constant weight.

Content of nitrogen, phosphorus and potassium in leaves

Content of nitrogen, phosphorus and potassium in leaves (mg/g) were determined at 3 times according to the method descriterrace by Kock and Mc Meckin (1924) for nitrogen, Troug and Meyer (1939) for phosphorus and Brown and Lilleland (1946) by flame photometrically for potassium.

Statistical Analysis

Data were statistically analyzed according to Snedecor and Cochran (1991). The Fishers protected least significant difference (LSD) at 0.05 was employed to separate the treatment means.

RESULTS AND DISSCUSION

Vegetative Growth and Chlorophyll

Effect of amino acids foliar application

Data presented in Tables 1 and 2 indicate that spraying cucumber plants with amino acids affected significantly plant height, number of leaves/plant, average leaf area, while chlorophyll content was not significantly affected in both seasons. Amino acids in essential quantities are well known as a means have positive effects on plant growth of different crops. Amino acids are fundamental ingredients in the process of protein synthesis, formation of plant tissue and chlorophyll synthesis. El-Shabasi *et al*. (2005) found that amino acids treatments improved significantly plant growth and its components. Similar effect and findings about amino acids were indicated by Abo Sedera *et al*. (2010) on strawberry and El-Desouky *et al*. (2011) on tomato.

Effect of some stimulants treatments

Data presented in Tables 1 and 2 shows the effect of some bio-stimulants on vegetative growth characters and chlorophyll content in the leaves of cucumber plants; results showed that cucumber plants treated with all stimulants, had significant effect on all studied vegetative growth characters (plant height, number of leaves and average leaves area) and chlorophyll content in the leaves compared with the control treatment. However, those stimulants, *viz.*, microbial inoculants, humic acid, EM and yeast strains (*Saccharomyces cerevisiae,* 110) increased plant height, number of leaves, average leaf area and chlorophyll content in the leaf compared with the control treatment during both seasons of study.

From the above-mentioned results, it can be noticed that, plants treated with microbial inoculants, humic acid and EM was the most favorable treatments for enhancing those characters, while yeast extract treatment was effective in enhancing vegetative growth and chlorophyll content in the leaves as compared with the other treatments. On the other hand, the lowest value in this respect was recorded in control. The increase in plant height, number of leaves/plant, average leaf area and chlorophyll content could be attributed to the beneficial effect of microbial inoculants that are ready to be used and improve the quality and the health of the soil and plant species by increasing the nutrient availability for the soil and plants. Biofertilizers naturally activate the microorganisms found in the soil restoring the soil's natural fertility and protecting it against drought and soil diseases and therefore stimulate plant growth (Han *et al*., 2006). EM contains selected species of microorganisms, including predominant populations of lactic acid bacteria, yeasts, smaller numbers of photosynthetic bacteria, actinomycetes and other types of organisms. All of these are claimed to be mutually compatible with one another and are

Table 1. Effect of using some stimulants and spraying of amino acids on some vegetative growth characters and chlorophyll content of cucumber leaves at 60 days after transplanting (DAT) in 2012/2013 season

Treatments: Spraying amino acids	Treatments: soil fertilizer with stimulants	Plant height (cm)	Number of leaves/plant	Average leaf area (cm^2)	Chlorophyll
Without (tap water)		170.6	19.3	229.66	31.28
With (2 g/l)		214.5	21.2	243.80	33.04
LSD at 5%		16.5	0.7	2.35	NS
	Microbial	228.3	25.3	259.33	35.40
	Humic acid	196.0	19.7	244.16	32.55
	EM	220.5	22.0	229.83	33.95
	Yeast extract	191.7	18.7	227.00	29.77
	Control (without)	126.3	15.7	223.33	29.27
LSD at 5%		20.6	3.7	4.77	2.98
Interaction (amino acids × stimulants)					
Without (Tap water)	Microbial	207.3	24.7	241.33	34.53
	Humic acid	218.3	19.0	227.66	32.40
	EM	162.3	21.0	234.66	33.20
	Yeast extract	157.0	17.3	223.66	28.40
	Control (without)	108.0	14.7	216.00	27.87
With (2 g/l)	Microbial	238.3	26.0	277.33	36.27
	Humic acid	229.7	20.3	239.00	32.70
	EM	233.7	23.0	251.63	34.70
	Yeast extract	226.3	20.0	230.33	31.13
	Control (without)	144.7	16.7	227.66	30. 67
LSD at 5%		29.2	5.3	5.99	4.22

Microbial: Microbial inoculants; mixture of nitrogen fixing bacteria (*Azotobacter* sp), phosphate dissolving bacteria (*Bacillus megaterium*) and potassium dissolving bacteria (*Bacillus circulans*).

EM: Effective microorganisms.

Table 2. Effect of using some stimulants and spraying of amino acids on some vegetative growth characters and chlorophyll content of cucumber leaves at 60 days after transplanting (DAT) in 2014/2015 season

Treatments		Plant height (cm)	Number of leaves/plant	Average leaf area (cm^2)	Chlorophyll
Spraying amino acids	**Soil fertilizer with stimulants**				
Without (tap water)		122.1	15.4	215.60	29.43
With (2 g/l)		167.7	18.4	224.73	31.08
LSD at 5%		12.9	1.3	0.24	NS
	Microbial	173.2	21.2	232.66	32.37
	Humic acid	151.3	19.0	221.33	31.87
	EM	165.4	14.2	218.16	30.42
	Yeast extract	138.7	16.3	215.33	28.52
	Control (without)	93.7	11.7	208.33	28.12
LSD at 5%		18.5	2.4	4.34	3.33
Interaction (amino acids × stimulants)					
Without (Tap water)	**Microbial**	148.0	20.0	231.66	31.67
	Humic acid	129.0	16.0	222.33	29.80
	EM	138.5	18.0	227.33	31.23
	Yeast extract	122.7	14.3	219.33	27.43
	Control	72.0	9.67	214.33	27.03
With (2 g/l)	**Microbial**	198.3	22.3	243.66	32.50
	Humic acid	174.7	18.3	226.33	32.40
	EM	191.4	20.0	233.00	31.03
	Yeast extract	154.7	16.2	224.33	29.60
	Control (without)	115.3	13.7	219.33	29.20
LSD at 5%		26.1	3.4	8.39	4.71

Microbial: Microbial inoculants; mixture of nitrogen fixing bacteria (*Azotobacter* sp), phosphate dissolving bacteria (*Bacillus megaterium*) and potassium dissolving bacteria (*Bacillus circulans*).

EM: Effective microorganisms.

able to coexist in culture. Yeast treatment plays a beneficial role in improving the formation of flower initiation due to its effect on carbohydrates accumulation. Also, it has a stimulatory effect on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (Swelam, 2012). Humic substances are generated through organic matter decomposition and employed as soil fertilizers in order to improve soil structure and soil microorganisms. Foliar sprays of these substances also promote growth in a number of plant species (Brownell *et al*., 1987; Yildirim, 2007; Karakurt *et al*., 2009; Halime *et al*., 2011) at least partially through increasing nutrient uptake, serving as a source of mineral plant nutrients and regulator of their release. Growth of tomato, cucumber and bean plants tended to be increased by treatments of humic acids (Atiyeh *et al*., 2002; Turkmen *et al*., 2004; Zaky *et al*., 2006). Different reports indicated that humic acid treatments improved growth and some fruit characteristics of various plants including cucumber, tomato, eggplant and pepper. Mahmoud *et al.* (2009) showed that cucumber plants sprayed with humic acid (0, 1 and 2 g/l) or seaweed extract (0, 2, and 3 ml/l) led to positive significant differences in leaf area and leaf chlorophyll content as compared to untreated plants. Also, it has a stimulatory effect on cell division and enlargement, protein and nucleic acid synthesis and chlorophyll formation (Swelam, 2012). Additionally, Mahmoud *et al.* (2013) found that yeast extracts improved pea vegetative growth with using the highest level of yeast extract (2%). Foliar application of yeast increased growth of lettuce (Fawzy, 2007), eggplant (El-Tohamy *et al*., 2008) and cucumber (Shehata *et al*., 2012).

Effect of the interaction

Data presented in Tables 1 and 2 refer to the combinations between foliar application of amino acids and some bio-stimulants; *viz*., microbial inoculants, humic acid, EM and yeast strains (*Saccharomyces cerevisiae,* 110) significantly affected number of plant height, number of leaves/plant, average leaf area, chlorophyll content of leaves compared with the control treatment (without treating) during both seasons of study. Foliar application of amino acids combined with microbial inoculants and EM gave the highest values of plant height, number of leaves/plant, average leaf area, and chlorophyll content of leaves comparing with other interaction treatments. These results were true in the two seasons of experiment. These results may be due to the role of nitrogen on synthesis of chlorophyll, enzymes and proteins which in turn increases the vegetative growth. Many investigators obtained data support the recent results among them El-Shabasi *et al.* (2005), El-Desouky *et al.* (2011) and Shehata *et al.* (2012). stimulants are an alternative to increase soil productivity and plant growth in sustainable agriculture.

Chemical Composition

Effect of amino acids foliar application

Data presented in Table 3 indicate that spraying cucumber plants with amino acids affected significantly K content in leaves while, dry weight of leaves was not affected significantly in both seasons. However, N content in first season only and P content in second season only in leaves were significantly affected. The highest values of K content in leaves in both seasons and N content in first season only and P content in second season only in leaves were obtained by amino acids, while the lowest values in all studied growth traits were obtained by application of control treatment (foliar spray with tap water). El-Shabasi *et al.* (2005) found that treatments of amino acids significantly improved plant growth and its components. Similar effect and findings about amino acids were indicated by Abo Sedera *et al.* (2010) on strawberry and El-Desouky *et al.* (2011) on tomato.

Effect of some stimulants

Data presented in Table 3 show that treating cucumber plants with bio-stimulants, *viz*., microbial inoculants, humic acid, EM and yeast strains (*Saccharomyces cerevisiae,* 110) increased dry weight of leaves and the content of N, P, and K in leaves. The microbial inoculants and EM gave the highest dry weight of leaves and the content of N, P, and K in leaves comparing with the other stimulants during both seasons of study.

The obtained results show that microbial inoculants and EM accelerated the decomposition

Table 3. Effect of using some bio-stimulants and spraying amino acids on chemical composition of cucumber leaves at 90 days after transplanting (DAT) in 2012/2013 and 2014/2015 seasons

Treatments		First Season				Second Season			
Spraying amino acids	Soil fertilizer with stimulants	DM (%)	N mg/g	P mg/g	K mg/g	DM (%)	N mg/g	P mg/g	K mg/g
Without (Tap water)		14.65	33.23	2.26	13.45	14.69	28.21	2.12	13.03
With (2 g/l)		15.26	29.81	2.30	12.74	14.89	27.21	2.16	12.69
LSD at 5%		NS	1.96	NS	0.03	NS	NS	0.01	0.32
	Microbial	16.10	30.45	2.11	15.00	15.64	27.13	2.06	12.53
	Humic acid	14.85	33.32	2.10	12.15	14.85	28.60	1.96	14.78
	EM	15.79	33.34	2.21	11.89	14.65	28.48	2.10	11.83
	Yeast extract	14.09	30.99	2.55	13.37	14.49	28.75	2.29	13.30
	Control (without)	13.95	29.50	2.43	13.08	14.31	25.58	2.27	11.86
LSD at 5%		1.28	1.33	0.10	0.28	0.33	1.40	0.08	1.11
Interaction (amino acids × bio-stimulants)									
Without (Tap water)	Microbial	16.01	34.51	2.11	13.72	15.22	28.48	1.94	13.27
	Humic acid	14.09	35.02	2.19	12.76	14.96	27.97	2.13	15.38
	EM	15.71	32.00	2.37	12.18	14.59	29.52	2.31	12.24
	Yeast extract	13.77	31.66	2.39	14.10	14.40	28.48	2.09	12.44
	Control (without)	13.67	32.96	2.24	14.49	14.26	26.59	2.14	11.79
With (2 g/l)	Microbial	16.18	26.38	2.11	16.28	16.07	25.79	2.17	11.79
	Humic acid	15.61	31.62	2.00	11.54	14.74	29.23	1.80	14.17
	EM	15.87	34.68	2.05	11.60	14.70	27.43	1.96	11.41
	Yeast extract	14.42	30.32	2.71	12.63	14.57	29.02	2.49	14.17
	Control (without)	14.23	26.04	2.61	11.67	14.36	24.58	2.39	11.92
LSD at 5%		1.82	1.88	0.13	0.39	0.46	1.99	0.11	1.58

Microbial: Microbial inoculants; mixture of nitrogen fixing bacteria (*Azotobacter* sp), phosphate dissolving bacteria (*Bacillus megaterium*) and potassium dissolving bacteria (*Bacillus circulans*).

EM: Effective microorganisms.

rate of compost applied to soils and enhanced the mineralization and availability of plant nutrients. Stimulatory effect on cell division and N, P and K content in plant leaves (Swelam, 2012). Also, Mahmoud *et al*. (2013) found that the highest values of macro – elements contents on leaves and stems were obtained by using stimulants treatments as compared with untreated plants of pea. Foliar application of yeast increased growth of lettuce (Fawzy, 2007), eggplant (El-Tohamy *et al*., 2008) and cucumber (Shehata *et al*., 2012).

Effect of the interaction

Foliar application of amino acids combined with microbial inoculants and EM gave the highest values of dry weight of leaves, the content of N, P, and K in leaves comparing with other interaction treatments in Table 3 comparing with other interaction treatments. These results were true in the two seasons of experiment. These results may be due to the role of nitrogen in synthesis of chlorophyll, enzymes and proteins which in turn increases the vegetative growth. Many investigators obtained data support the recent results Mahmoud *et al*. (2013) found that the highest values of macro – elements contents on leaves and stems were obtained from using stimulants treatments as compared with untreated plants of pea. Foliar application of yeast increased growth of lettuce (Fawzy, 2007), eggplant (El-Tohamy *et al*., 2008) and cucumber (Shehata *et al*., 2012).

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تأثير بعض المنشطات والرش بالأحماض الأمينية علي النمو والتركيب الكيماوي لنباتات الخيار المزروعة تحت ظروف الصوب

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أجريت الدراسة الحالية خلال موسمين 2013/2012 و 2015/2014 في مزرعة كلية الزراعة - جامعة القاهرة في العروة الخريفية المبكرة لدراسة تأثير الأحماض الأمينية كرش ورقي واستخدام أربع منشطات وهي (التلقيح البكتيري عبارة عن خليط من البكتريا المثبتة للنيتروجين (*Azotobacter* sp) وبكتريا مذيبة للفوسفات (*Bacillus megaterium*) وبكتريا مذيبة للبوتاسيوم (*Bacillus circulans*)، وحامض الهيوميك، effective microorganisms) EM)، ومستخلص الخميرة (*Saccharomyces cerevisiae,* 110) كتسميد أرضي إلى جانب معاملة الكنترول (بدون أي منشطات) على النمو والمكونات الكيميائية لنبات الخيار صنف صفا 62، وقد تضمنت التجربة 10 معاملات ناتجة من التوافيق بين مستويين من الأحماض الأمينية (صفر و 2 جم/لتر) وأربع منشطات واستخدم تصميم تجربة عاملية بثلاث مكررات، حيث أن الرش بماء الصنبور (معاملة الكنترول)، وأشارت النتائج إلى أن رش نباتات الخيار بالأحماض الأمينية أثر معنوياً على ارتفاع النبات، وعدد الأوراق، ومتوسط المساحة الورقية، ومحتوى الأوراق من البوتاسيوم بينما محتوى الكلورفيل، والوزن الجاف للأوراق كانت غير معنوية في كلا الموسمين علاوة على أن محتوى النيتروجين في الموسم الأول فقط ومحتوى الفوسفور في الموسم الثاني فقط بالأوراق كانت معنوية، محتوي الفوسفور في الموسم الأول فقط ومحتوي النيتروجين في الموسم الثاني فقط كان غير معنوي، كما أدت المنشطات إلى زيادة في ارتفاع النبات، عدد الأوراق/ النبات، ومتوسط المساحة الورقية، ومحتوى الكلوروفيل في الورقة، والمادة الجافة في الأوراق، ومحتوى النيتروجين والفوسفور والبوتاسيوم في الأوراق مقارنة بالكنترول، وكل صفات النمو الخضري، والمكونات الكيميائية في هذه الدراسة بينما سجلت أقل القيم معنوياً من معاملة الكنترول، بينما معاملة التلقيح البكتيري و EM أعطت أعلي القيم في ارتفاع النبات، عدد الأوراق، متوسط المساحة الورقية، محتوى الكلوروفيل في الورقة، المادة الجافة في الأوراق، ومحتوي النيتروجين والفوسفور والبوتاسيوم في الأوراق مقارنة بالمنشطات الأخرى، كما أن الإضافات للأحماض الأمينية مع التلقيح البكتيري وأيضاً الأحماض الأمينية مع EM أعطت أعلى القيم في كل صفات النمو الخضري والمكونات الكيميائية في هذه الدراسة مقارنة بالمعاملات الأخرى.

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