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EFFECT OF ADDITION POTASSIUM AND SPRAY (HUMIC AND FULVIC) ACIDS APPLICATION ON SOME GROWTH AND YIELD CHARACTERISTICS OF SQUASH, *CUCURBITA PEPO* L.

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ABSTRACT : A field experiment was conducted during the autumn season 2017 at one of the fields in Al-Hamdaniya area of the Abu-Ghraib district 15 km west of Baghdad, in a salty clay loam texture soil. To study the effect interaction of three levels of additionpotassium0, 75 and 150 kg.h^{-1} (K_1 , K_2 and K_3) respectively and mixture of (humic and fulvic) acids, 0, 250 and 500 mg l^{-1} (H_0 , H_1 and H_2) respectively, on some growth and yield characteristics of squash zucchini *Cucurbita pepo* L. A randomized complete block design (RCBD) with Split Plot distribution with three replications was used. The levels of addition potassium occupied the main plots. The mixture of acids levels were occupied sub plots, the most important results that have been obtained, Increasing of additionpotassium as K_2, K_3 resulted in a significant increasing in some traits under study (dry weight of shoot, total soluble sugars concentration, proline concentration, fertilizer use efficiency, Concentration N, P, K comparison with K_1. Also the high addition potassium (K_1, K_2) caused a significant increasing in fertilizer use efficiency (43.00, 52.07%) respectively comparison with K_0 (3.94%), increasing of addition potassium as K_2 resulted in a significant increasing in some traits under study (Plant length, leaf area, number of fruits comparison with K_0, K_1. Also the high addition potassium (K_2) caused a significant increasing in total yield 22.83 ton.ha^{-1} comparison with K_0, K_1 (15.70, 20.43ton.ha^{-1}). Also the high addition potassium (K_2) caused a significant increasing in respectively N, P, K. Increasing of humic and fulvic acids as levels H_2, H_3 resulted in a significant increasing in some traits under study (Plant length, leaf area, number of fruits, comparison with H_0. Also the high level (H_2) caused a significant increasing in total yield 20.02 ton.ha^{-1} respectively comparison with H_0 (19.26 ton.ha^{-1}). Also, the high (H_2) caused a significant increasing in respectively N, P, K. The interaction between of the study factors were significant at most of measurement characteristics. The treatment K_2XH_2 gave the highest value in total yield (23.50 ton.ha^{-1}) comparison with K_0XH_0 (14.84 ton.ha^{-1}).

Key words : *Cucurbita pepo* L, potassium, humic and fulvic acids, randomized complete block design (RCBD), leaf area.

INTRODUCTION

The Potassium considers as one of the most important elements for the plant, where it plays a huge role in the activation of many enzymes and stimulates more than 70 enzymes inside the plant. The Potassium also has a significant role in the process of photosynthesis by activating the enzymes associated with this process, energy transfer and building Adenosine 5' triphosphate ATP. ATP stores the energy needed to analyze CO_2 and in the synthesis sugars, starch and proteins. As well as, ATP is the main carrier of energy in the plant, it also accelerates the transfer of processed materials to storage sites. (Al -Muharib and Al- Daraji 2017, Kazemi 2013) found a significant increase in the traits that studied in their research on cucumber and Cucurbita pepo plant. Humic + fulvic acids, play an active role in the increasing ofthe permeabilityfor cellular membrane that made the water and nutrient absorption more effectively in the plant, which helps the movement of metals and their transfer in the plant. Enzyme activation is also an important characteristic, this can be explained by the presence of a group of alkaloids in the humic acid that acts as a receptor for hydrogen, at thesame time, oxygen is an encouraging factor and chemical agent foroxidation and redox processes. Humic acids that entered in the plant at the early stages of their development as a multiple phenol supplement, which act as a chemical breathing agent that increased the plant vitalefficiency. In additional to that, the enzymatic system becomes more efficient, the root system develops, cell division and dry material increases, (Meenaet al 2017, Shafeek et al 2016) found significant increases in the studied traits in cucumber and Cucurbita pepo plant. Cucurbita pepo plant is one of the most important crops of the Cucurbita family, which is an important vegetable that grown in Iraq in the autumn and spring seasons. the production of Cucurbita in Iraq for the year 2017 was 19864 tons for 8457 dunums as a planted area, with a yield of 2348.8 kg/dunums according to the Central Statistical Organization for Agricultural Statistics (2017). The important of this type of vegetables coming from their pulp include the carbohydrates, protein, calcium, iron, phosphorus and a number of vitamins, as well as it seeds that contain 30% of oil, vitamins and zinc minerals and are used for different purposes such as cooking as well as medical uses (Matlub, 1989). The aim of study was to evaluate the effect of foliar application of mixture of humic acids and potassium additionon some growth and yield characteristics of squash.

MATERIALS AND METHODS

A field experiment was carried out in one of the private fields belonging to Mr. Mohamed Khudair Abbas during the autumn season 2016/2017 in Al-Hamdaniya area of the Abu Ghraib district in a salty clay loam soil classified as the Typic Torrifluvent level according to the United States Soil Survey Staff (2006). 10 samples of field soil were taken to depth 0-0.3 m and mixed as a compound sample, these samples were dried, then crushed with a wooden hammer andsifted with a 2mm diameter sieve. These samples were used to estimate the physical and chemical field soil properties as shown in Table 1. The experiment site was plowed by turning ploughs using perpendicular tipping of plowing, then the filed was divided into three main sectors representing the additional potassium treatments. Each sector was subdivided to three replicates containing 18 raised beds, six per each level of spray with humic acids with 5 m length and 0.8 m wide, the clear distance between the bed was 0.8 m while it was 1 between each sector in order to prevent interaction of the irrigation coefficients. The number of treatments in the experiment were 9 experimental units designed according to the RCBD with three replicates, while the results were analyzed using the GenStat program to select the lowest significant difference was chosen at ($P < 0.05$) to compare the arithmetic means of the coefficients. The experiment included the following coefficients: addition of Potassium coefficients: K_0 : No addition of potassium (comparison treatment), K_1: 75 kgh^{-1}, K_2 : 150. Spray treatments with humic acids based on (Schnitzer and Khan, 1978) method that modified and adopted by Page *et al* (1982) was used in the extraction of humic acids from the organic material by taking 1 of Bait Buniaa's peat moss from them, these wastes were treated with potassium hydroxide solution KOH (N1) instead of sodium hydroxide with a mixing rate 1:5 (1 kg dissolved organic material : 5 liters of potassium hydroxide solution). The alkaline solutions were shacked for 24 hours, then the sediment was separated from the leachate and the humic and fulvic acids solution was collected to spray it on the plants as specified in Table 2.

The spray treatments included : Without spraying (comparison treatment), spray with 250, spray with 500. The seeds of *Cucurbita pepo* plant class (Anwar F_1) were planted in a steroforms dishes on 17/8/2017 for the autumn season, these dishes were filled with peat-moss and seed. After 7 days of seedling growth, the seeding was transferred and planted in the hills on 24 \ 8 \ 2017 in field with 40 cm between each hills. According to (Al-Zubaidi, 2007), the Nitrogen and phosphorus elements were added as (320, 200), respectively, while the Potassium was added as (150)according to Ali *et al* (2014). The addition of Potassium was in the form of high Potassium NPK fertilizer (5.3.45) all at once based

Table 1 : Physical and chemical properties soil.

Characteristic	The value	Unit	Characteristic	The value	Unit
pH1:1	7.8	–	Gypsum	0.7	$gm.kg^{-1}$
EC	3.2	$dcm.m^{-1}$	$CaCO_3$	235	$gm.kg^{-1}$
Organic matter	14	$gm.kg^{-1}$	CEC	28.17	c mole c kg^{-1}
Ca^{+2}	1.36	c mole c kg^{-1}	SO_4^{-2}	2.1	c mole c kg^{-1}
Mg^{+2}	0.84		HCO_3^-	0.35	
Na^+	0.97		CO_3^{-2}	Nill	
K^+	0.13		Cl^-	1.9	
Available Nitrogen	55	$mg.kg^{-1}$.	Soil separators $gm.kg^{-1}$	sand	150
Available Phosphorus	19.8			Green	470
Available Potassium	128			sand	380
Available Water	18.2%		Soil texture	Silty clay loam Si C L	

Table 2 : Mixture of humic and fulvic acids properties extracted from dissolved organic materials.

Characteristic	**PH**	**Electrical conductivity**	**Organic Carbon**	**Total nitrogen**	**Carbon / nitrogen**
The value	7.2	2.0	36.67	2.2	16.67
Unit	–	$dcm.m^{-1}$	$gm.kg^{-1}$	$gm.kg^{-1}$	–
Characteristic	Total phosphorus	Total potassium	Total magnesium	Humic acids	Fulvic acid
The value	7.2	167.3	1.30	18.6	6.31
Unit	$mg.kg^{-1}$			%	%

on the fertilizer recommendation for each treatment grafting on distance 7 cm with cultivation.

The following characteristic are studied :

Dry shoot weight ($gm.plant^{-1}$)

The root weight was measured by taking the mean of five plant root weight for each treatment after drying process at a temperature of 60^0C.

Plant length (cm)

The plant characteristic that related with length was calculated using a normal measuring tape, the distance between the earth and the pinching for the five plants was measured in cm units in order to record this reading and to calculate the average.

Leaves area (dcm^2plant^{-1})

The leaves area at the fifth fruit cutting was calculated for random samples, 30 heads (0.015) of five leaves were taken for each of the five plants that selected in the experimental unit each heads and leaves dried separately. Depending on the dry weight and heads area the area of leaves were determined according to the following equations (Watson and Watson, 1953).

$$\text{Leaves area} = \frac{\text{Heads leaves area}\left(dcm^2 plant^{-1}\right) \times \text{Dry weight of plant leaves}\left(gmplant^{-1}\right)}{\text{Heads dry weight}\left(gmplant^{-1}\right)}$$

Number of fruits ($plant^{-1}$)

The number of fruits were counted from the first cutting till the end of the season and it was divided on the number of plants in the experimental unit according to the following equation:

$$\text{Number of fruits} = \frac{\text{Total number of fruits in experimental unit}}{\text{Number of plants in experimental unit}}$$

Total yield (tons ha^{-1})

The total yield of plants was calculated by dividing the yield of 10 plants on their numbers, while the yield of both the experimental and one hectare were calculated according to the following equations.

$$\text{Total yield} = \frac{\text{Yield of experimental unit} \times \text{Hectare area}}{\text{Experimental unit area}}$$

Yield of experimental unit (Yield of one plants *the total number of plant in the experimental unit).

6. Prolin was evaluated according to the method that implement by Bates *et al* (1973), using the sulphosilic, ice acetic and nenhydrin acids. The absorption was measured using Spectro Photometer at a wavelength of 520 nanometers.

7. The ratio of the total soluble solids S.S.T was calculated by taking a drops from the fruit juice using the Hand Refractometers device and it was estimated of each experimental unit.

Use of fertilizer %

The efficiency of fertilizer was calculated according to the following equation (%) =

$$\frac{\text{Yield of fertilized treatment} - \text{Yield of comparison treatments}}{\text{Comparison yield treatment}} \times 100$$

9. The potassium was estimated using Flame Photometer according to the method proposed by Haynes (1980).

10. Phosphorus was estimated using ammonium polysaccharides and ascorbic acid by implement the Spectro Photometer and a wavelength of 882 nm as indicated in Page *et al* (1982)

11. The total nitrogen content of the microelectronic device is estimated according to the method described by Bremner (1965) and showed by Page *et al* (1982).

RESULTS AND DISCUSSION

Dry weight of shoots

The results showed that the foliar addition of potassium had a significant effect on the increase of the average biomass of the roots as shown in Table 3. The treatment achieve the highest value of $212.2gm.plant^{-1}$ with an increase rate of 34.99 and 16.02% compared to 182.9 and $157.2gm.plant^{-1}$ for K_0 & K_1, respectively. This increment caused by the huge role played by the potassium in increasing the weight of the root and the spread depth

Table 3 : The role of potassium and humic acids in influencing the growth characteristics and the yield of *Cucurbita pepo* plant.

Potassium Levels	Humic acids	Dry weight of shoots gm.plant^{-1}	Plant height cm	The leaves area of the plant dsm^{2-}.plant^{-1}	Number of fruits Fruit. plant^{-1}	Total yield ton.h^{-1}
K0	H0	22.85	43.9	7.73	4.016	14.84
	H1	25.13	47.5	8.32	4.430	15.85
	H2	29.21	50.4	8.71	5.160	16.40
K1	H0	40.71	53.6	10.14	5.258	20.16
	H1	36.47	57.8	10.37	6.582	20.41
	H2	32.77	60.6	10.75	7.201	20.72
K2	H0	45.57	66.5	12.39	6.288	22.23
	H1	41.35	69.1	12.40	6.472	22.76
	H2	37.60	74.1	12.95	7.221	23.50
LSD 0.5		0.23	0.23	0.113	0.544	0.77
Average potassium						
K0		25.73	47.3	8.25	4.535	15.70
K1		36.65	57.3	10.42	6.347	20.43
K2		41.51	69.9	12.58	6.660	22.83
LSD 0.5		0.13	0.6	0.068	0.314	0.45
Average of humic acids						
H0		31.07	54.6	10.09	5.498	19.26
H1		34.32	58.1	10.36	5.828	19.68
H2		38.50	61.7	10.80	6.216	20.02
LSD 0.5		0.13	0.6	0.068	0.314	0.45

of shoot and vegetal sum and their branches (Widders and Lorenz, 1979). The results of the statistical analysis showed that there was a significant difference in the mean of biomass when spraying the humic acids, the level of H_2 was achieved the highest value of the studied traits of 190.8gm.plant^{-1} and the increase ratio of (6.65 and 4.43%) compared to the levels of (178.9 and 182.7^{-1}) for H_1 and H_2, respectively. This behavior resulted from the role that humic acids played in increasing root branches, root hairs increase followed by increasing of the surface area of the Rooty and vegetal sum thus increases the biomass of the roots (Faust, 1998). The effect of the interaction between potassium and of humic + fulvic acids spray levels was significant in this trait, where the highest value was 244.6gm.plant^{-1} for the treatment of K_2H_2 and the lowest value of 153.9gm.plant^{-1} at K_0H_0 treatment with an increase rate of 46.32%.

Growth characteristics

The results showed that the foliar addition of potassium has a significant effect on the increase of average plant height. The treatment K_2 achieve the highest length at 69.9 cm with an increase of (47.78 and 21.99%) compared to (47.3 and 57.3cm) for K_0 & K_1, respectively as shown in Table 3. The results also showed a significant difference in the average height of the plant when spraying with the humic and fulvic acids, the level of H_2 achieve the highest value of the studied trait at 61.7 cm, with an increase of (13% and 6.2%) in relation to the levels (54.6 and 58.1cm of H_1 and H_2. The effect of the interaction between potassium and humic+ fulvic acid spray levels was significant in this trait, with a maximum value was 74.1 cm for K_2H_2 and minimum value was 43.9 cm for K_0H_0 with an increase rate of 68.79%. Table (3) also presented that the foliar addition of potassium had increased the average leaves area. The treatment K_2 achieve the highest value (12.58 dcm^{2}plant^{-1}), with an increase of (52.48 and 20.73%) compared to (8.25 and 10.42 dcm^2 plant^{-1}) for K_0 & K_1, respectively. As well as, a difference was noted in the average leaves area when spraying humic + fulvic acids, the level of the H_2 was achieve the highest value of the studied trait at (10.80 dcm^2 plant^{-1}) and the increase of (7.04% and 4.25%) Compared to the level of (10.09 and 19.70 dcm^2 plant^{-1}) for H_0 and H_1. As for the effect of the interaction between potassium levels and levels of humic+ fulvic acids spray it was significant in this trait, the highest value was 12.95 dcm^{2}plant^{-1} for the treatment of K_2H_2 and the lowest value of 7.73dcm^{2}plant^{-1} in the treatment of with an increase rate by 67.53%. The increase in plant growth characteristic with the addition of potassium resulted from its effect on the plant height by increasing the division and elongation of the meristematic tissues and achieving perfect bulge of the cell wall, which present good agreement with Dulaimi (2010) results. The potassium also increase the leaves area by delaying the aging of the leaves and through the formation of a good vegetative group, this was caused by the effect of potassium in the process of photosynthesis, which was increased the cell division that lead to the leaves area increases which present a good agreement with Ali and Aziz (2003) findings. The increase in vegetative growth properties can also be explained by the role of humic+ fulvic acids in increasing the permeability of the cell membrane. Thus, the absorption of water and nutrients becomes more effective in the plant, which helps the metals movement and their transport in the plant, cellular division increment and the cells elongation that made growth rate cell division was in high performance leading to increased plant height and leaves area (Pettit, 2003; Seen and Kingman, 1998).

Yield characteristic

The results indicate that there were a significant effect of the addition of Potassium fertilizer to the soil in the increase of the average number of fruits, the yield reached the highest value of (6.660 fruits plant$^{-1)}$ in the treatment of K_2 where the rate of increase was (46.86 and 39.96%) when compared with the level of addition (4.535 and 6.347 fruits plant^{-1}) for K_0 and K_1(t) as shown in Table 3. the statistical analysis findings showed a significant difference in the number of fruits when spraying humic+ fulvic acids, it reached the highest value of (6.216 fruits plant^{-1}at the treatment of H_2. The rate of increase was (13.05 and 5.64%), if it compared to the treatment (5.498 and 5.838 fruits plant^{-1}) for H_0 and H_1. The interaction between the addition of potassium and the humic+ fulvic acids spraying based on statistical analysis showed the highest value was 7.221 fruits plant^{-1} for the treatment of K_2H_0 and the lowest value of (4.016 fruits plant^{-1}) in the treatment of K_0H_0 with an increase rate of 79.81%. Table 3 also presented that the addition of potassium has a significant effect on the increase of the early yield average by (4.23 tons ha^{-1}) at the treatment of K_2 where the increase rate were (37.79 and 4.19%) if it compared with the levels of (3.07 and 4.06 tons ha^{-1}) for K_0 and K_1. A significant difference was noted in the mean of the total yield when spraying the humic acids, the yield reached the highest value of (20.02 tons ha^{-1}at the treatment of H_2, the increase rate was (3.94 and 1.73%) if it compared with (19.26 and 19.68 tons ha^{-1}) H_0 and H_1. The results showed a significant effect of the dual interference between the addition of potassium and the humic+ fulvic acids spraying. The highest value was (4.50 tons ha^{-1}) for the treatment of K_2H_1 and the lowest value of (3.00 tons ha^{-1}) at the treatment of K_2H_0 with an increase rate of 33.33%. These findings resulted from the effect of potassium on the yield characteristic due to the huge role that played by potassium in increasing the activity of enzymes, then regulate the biological processes such as stimulation of flowering and knot that take place within the plant tissue as mentioned in Gunes and Inal (1998) and Xuan (1999). The potassium also has a significant role in the process of photosynthesis by activating the enzymes associated with this process, energy transfer and building ATP. ATP stores the energy needed to analyze CO_2 and in the synthesis sugars, starch and proteins. As well as, ATP is the main carrier of energy in the plant, it also accelerates the transfer of processed materials and store them in the fruits (IPI, 2000). The effect of potassium in the increasing the yield can be attributed to the it concentration in the plant and the soil as well as its positive effect in the absorption of nitrogen and phosphorus and increase their concentrations in the plant. The presence of the best conditions to improve the nutrient balance among these three nutrients lead to enhance the activity of biological processes within the plant, which was reflected in the increase of the yield, which present a good agreements with Wilcox (1964) and Pefluger and Mengel (1972) findings.

Humic fulvic acids also play a effective role in enhancing the yield characteristics through their role in various vital activities of the plant such as respiration, photosynthesis, protein synthesis and various enzymatic reactions, resulting in an increase in manufactured alimentary in plant such as carbohydrates and then the yield was increased (Williams, 1993) and the results are similar to Habashy and Ewes (2011) on *Cucurbita pepo* plant.

Total dissolved sugars

The results showed that the potassium foliar application has a significant effect on average soluble sugars increment. The treatment K_2 achieve the highest value of 1.78% with an increase of (8.54 and 1.14%) compared to the treatment of (1.64% and 1.76%) for K_0 and K_1, respectively. This increase can be explained by the huge role played by potassium by activating the enzymes associated with the process of photosynthesis as mentioned previously. A significant difference was noticed in the average soluble sugars when spraying humic+ fulvic acids, the highest level of the measured value was 1.77% with an increase rate of (4.7 and 2.91%) compared to the level of (H_1 1.72% and H_0 1.69%). These acids increase the accumulation of sugars, where its change the pattern of carbohydrates metabolism, which increase the oosmotic pressure inside the cellular walls and make the plant more drought-resistant and also increase the ability of the immune system of the plant (Syltic, 1985). As for the effect Interaction between potassium levels and soil spraying levels Humic has additional was significant in this capacity, which reached the highest value of 1.82% for the treatment K_2H_2 and less value of 1.58% when treated K_0H_0 by an increase of 15.19%.

Fertilizer use efficiency

Table 4 showed that the potassium foliar application has a significant effect on the efficiency of fertilizer use. The treatment K_2 achieve the highest value of 52.07% if it compared to the coefficient of (3.94% and 34.00%) and for K_0 and K_1. This component plays a positive influence on the various metabolic processes in the plant by stimulating it to more than 80 enzymes in addition to its main role in the transfer of photosynthesis products from the manufacturing sites to the storage places. This effect was reflected in the increase in productivity of the unit area through the increase in the average size of fruits which wasincreased the efficiency of fertilization (Abo Dahi and Alyounis, 1988). The results showed a significant difference in the efficiency of fertilizer use when spraying humic+ fulvic acids, where achieved the highest value for the studied characteristic of 3.11 compared to H_0 (26.64) and H_1 (30.26). The significant increase in fertilization efficiency achieved by spraying humic acids may be due to the different positive effects in the growth and production of the plant, which was discussed earlier, which caused an increase in the efficiency of fertilization when spraying these acids. As well as, the effect of the interaction between potassium levels and levels of humic acid spray was significant in this capacity, with the highest value of 55.43% for the treatment of K_2H_2 and the lowest value of 1.66% in the treatment of K_0H_1.

Nitrogen concentration

The results showed that the adding of potassium fertilizer to the soil had a significant effect on average nitrogen concentration increments in the fruits as shown in Table 4. The highest value of 2.45% for the treatment of K_2 with an increase of 5.60% compared to the treatment of K_0 (2.32), while the difference was not a significant between the two coefficient K_1 and K_2. The results of the statistical analysis showed that there was a significant difference in the average nitrogen concentration in fruits when spraying humic+ fulvic acids, with the highest value of H_2 treatment (2.47%) and an increase of 8.33% compared to H_0 (2.28). While the difference between the treatments (H_1 and H_2) were not a significant in this a trait.

Concentration of phosphorus

The results of the statistical analysis showed that there was a significant effect of potassium fertilizer on increasing the average concentration of phosphorus in fruits as listed in Table 4. These concentration reached a maximum value of 0.375% in the treatment of K_2 and an increase of 13.98 and 3.88% compared to K_0 (0.329%) and K_1 (0.361%). The results of the statistical analysis showed a significant difference in the mean phosphorus concentration when spraying humic acids relative to the treatment. As it reached a highest value in H_2 was 0.396% and an increase (35.15%), (5.32 %) compare with H_0 (0.293%) and H_1 (0.376%).

Concentration of potassium

The results of Table 4 showed that the adding of potassium fertilizer to the soil had a significant effect on the increase of the average concentration of potassium in the fruits, which reached the highest value of 2.635% at the treatment of K_2 with an increase of 112.5 and 23.19% compared with K_0(1.240%) and K_1(2.139). The results showed a significant difference in the average concentration of potassium when spraying humic+ fulvic acids, which reached 2.063% at H_2 with an increase of 7.22 and 1.82% compared with H_0(1.924%) and H_1(2.026), respectively. The significant increase in the concentration of nitrogen obtained from plant processing in potassium can be attributed to the fact that the processed nitrogen was well consumed when the amount of added potassium is appropriate. Potassium has an important effect in enzyme activation (Nitrate reductase), which affects in nitrate reduction in the leaves and converts it into ammonia which is the raw material for amino acids formation that necessary for the formation of proteins. As well as the role of potassium in the enzyme activation (Kinase), which stimulates the formation of proteins and also potassium contributes in the conversion of light energy to chemical energy in the form of ATP in the process of phosphorylation. The energy is necessary in all vital processes such as the manufacture of proteins, carbohydrates ,fats and the process of filling the sieve tubes with photosynthesis products with high molecular weights and then their transfer to storage places and the accompanying increase in dry matter, which is reflected on the absorbent of the nitrogen element (Mengel, 1982). The potassium plays a role in photosynthesis where the

Table 4 : Effect of potassium and spray of humic acids in the effect on the dry weight of the roots and percentage of proline and total dissolved sugars and the efficiency of fertilizer use and the concentration of nitrogen, phosphorus and potassium in *Cucurbita pepo* plant.

Potassium Levels	Humic acids	TSS	Fertilizer use efficiency	Nitrogen concentration	Concentration of phosphorus	Concentration of potassium
K0	H0	1.58	1.66	2.15	0.268	1.173
	H1	1.77	3.47	2.38	0.343	1.261
	H2	1.77	6.68	2.43	0.353	1.284
K1	H0	1.71	30.39	2.38	0.321	2.096
	H1	1.77	34.41	2.43	0.399	2.148
	H2	1.78	37.21	2.44	0.407	2.173
K2	H0	1.62	47.87	2.31	0.291	2.504
	H1	1.70	52.90	2.46	0.387	2.669
	H2	1.82	55.43	2.57	0.428	2.731
LSD 0.5		0.02	0.78	0.07	0.004	0.048
Average potassium						
K0		1.64	3.94	2.32	0.329	1.240
K1		1.76	34.00	2.42	0.361	2.139
K2		1.78	52.07	2.45	0.375	2.635
LSD 0.5		0.01	0.45	0.04	0.002	0.027
Average of humic acids						
H0		1.69	26.64	2.28	0.293	1.924
H1		1.72	30.26	2.44	0.376	2.026
H2		1.77	33.11	2.47	0.396	2.063
LSD 0.5		0.01	0.45	0.04	0.002	0.027

average of Photophosphorylation increased, And of course the plant need phosphorus that's what increases in the phosphorus absorption (Pfluger, Mengel, 1972) and (Viro, 1973). The addition of Potassium fertilizers leads to an increase in the development of the root growth, which increases the absorption rate of nutrients, including phosphorus, as noted by (Widders and Lorenz, 1979). The increase in the concentration of potassium is also due to the increase in additive levels contribute effectively to plant processing requirements of the Potassium element as suitable for the plant's need it This increases its absorption by the plant and increases its concentration in the tissues. This is consistent with what (Locascio, Dangler, 1990). The reason of the concentration of elements increment when spraying humic acids to the ability of the plant to benefit from the added nutrients and the speed of absorption and representation, which was one of the advantages of leaves feeding by humic+ fulvic acids and thus increase its concentration in the plant, as well as its role in the construction of various compounds within the vegetative growth of the plant, and in the efficiency increasing of biological activity thus Increase the susceptibility of the plant to the absorption of various nutrients which present a good agreement with (Michael *et al*, 1970) findings. The spraying of humic+ fulvic acids increased the ability of the plant to absorb the nutrient that needed from the soil solution as well as, its absorption of nutrients in humic acids. This may be due to the fact that spraying the plant with humic+ fulvic acids increased the permeability of cellular membranes as the acid molecule can enter the nutrient stream in the cell and make the membranes more permeable, that allowing for increased nutrient input and cell division, thus increases the speed of nutrient entry this effect is linked to the function of the active groups of hydroxyl and carboxylic in humic acids (Chen and Aviad, 1990).

REFERENCES

Abo dhahi Y M and Al-Younis M A (1988) Guide of plant nutrition. Ministry of Higher Education and Scientific Research, Baghdad University, Iraq.

Al –Muharib M Z and Al- Daraji S A R (2017) Effect of potassium fertilizer and Organic nutrient ingrowth and yield of cucumber. *Al - Furat Agricultural Journal* **9**(1), 75-84.

Al-Dulaimi H A (2010) Effect of potassium levels and distance between lines in growth and yield characteristics for two kinds of white corn. *Master thesis*, Collage of Agriculture, University of Anbar. P.48-77

Ali N E S and Aziz M H (2003) Effect of fertilization with phosphorus and potassium in yield of white corn and Water use efficiency.

Journal of Iraqi Agricultural Sciences **40-35**, 1 (34).

Bates L, Waldren R P and Teare I D (1973) Rapid determination of free proline for water-stress studies. *Plant and Soil* **39**, 205-207.

Bremner J and Keeney D (1965) Steam distillation methods for determination of ammonium, nitrate and nitrite. *Anal. Chim. Acta* **32**, 485-495.

Chen Y and Aviad T (1990) Effect of humic substance on plant growth. selected reading. In: Amer. Soc .of Agron. 161-186. Madison W I. Potassium fertilizer application. *Polish Scientific Journal* **54**, 117 – 126.

Dangler J M and Locascio S J (1990) Yield of trickle irrigated tomatoes as affected by time of N and K application. *Journal of the American Society for Horticultural Science* **115**, 585-589.

Faust R H (1998) Humate and humic acid Agriculture users guide. Novaco marketing and management services. Australian Humates.

Gunes A M A and Inal A (1998) Critical nutrients concen - trations and antagonistic and synergistic. *J. Plant Nut*. **21** (10), 2035 – 2047.

Habashy N R and Ewees M S A (2011) Improving Productivity of Zucchini Squash Grown Under Moderately Saline Soil Using Gypsum, Organo-Stimulants and AM-fungi. *Journal of Applied Sciences Research* **7**(12), 2112.

Haynes R (1980) A Comparison of two modified kjeldhal digestion techniques for Multi- element plant analysis with conventional wet and dry ashing methods. *Comm. Soil Sci. Plant Analysis* **11**(5), 459-467.

International potash Instiute (IPI) (2000) Potassium increases salinity tolerance file:A:/IPI Serves the world.

Kazemi M (2013) Effect of Foliar Application of Humic Acid and Potassium Nitrate on Cucumber Growth. *Bulletion of Environment, pharmacology and life sciences* **2**(11), 03-06.

Matlub A N, Mohammed E S and Abdool K S (1989) Production of vegetablespart One(Second revised edition). Ministry of Higher Education and Scientific Research, University of Mosul, Iraq.

Meena S, Ameta K D, Kaushik R A, Meena S L and Singh M (2017) Performance of Cucumber (*Cucucmis sativus* L.) as Influenced by Humic Acid and Micro Nutrients Application under Polyhouse Condition. *International Journal of Current Microbiology and Applied Sciences* **6**(3), 1763-1767.

Michael G, Allinger P and Wilberg E (1970) Einige Aspekte zur hormonalen Regulation der Korngrii Be bei Getreide. *Z. Pflanzenerniihrung und Bodenkunde* **126**, 24-35.

Page A L, Miller R H and Kenney D R (1982) *Methods of soil analysis*. Part (2). 2nd. Ed. Agronomy 9.

Pefluger R and Mengel K (1972) Photochemical activity of chloroplast obtained from plants with differrent potassium nutrition. *Plant and Soil* **36**, 417- 425.

Pettit R E (2003) Emeritus Associate Professor Texas A & M university, Organic Matter, Humus, Humates Humic Acid, Fulvic Acid and Humin: Their Importance in Soil Fertility and Plant Health.

Schnitzer M and Khan S (1978) *Soil Organic Matter*. Elsevier Company, N Y, USA.

Seen T L and Kingman A R (1998) Humus and humic acid. research series review no. 145, S.C. Agricultural Experiment Station, Clemson, south Carolina, USA.

Shafeek M R, Helmy Y I and Omar N M (2016) Effect of spraying or ground drench from humic acid on growth, total output and fruits nutritional values of cucumber (*Cucumis sativus* L.) grown under plastic house conditions. *International Journal of PharmTech Research* **9**(12), 52-57.

Syltic P W (1985) Effect of very small amount of highly active biological substance on plant growth. *Biological Agriculture and Horticulture Journal* **2**(2), 245-269.

Viro M (1973) The effect of varied nutrition with potassium on the translocation of assimilates and minerals in *Lycopersicon esculentum*, Giessen, Germany: Justus Liebig Universität. Dissertation, Fachbereich 19, Ernährungs wissens chaften.

Watson D J and Watson M A (1953) Comparative Physiological studies on the growth of yield crops. *Annals of Applied Biology* **40**(1), 1-37.

Widders I E and Lorenz O A (1979) Tomato root devel-opment as related to potassium nutrition. *J. Amer. Soc. Hort. Sci.* **104**, 216 – 220.

Wilcox E G (1964) Effect of potassium on tomato growth andproduction. *Amer. Soc. Hort. Sci*. **85**, 484 – 489.

Xuan P T (1999) Effect of potassium on seed production of cherry tomato. Asian Regional Center, AVRDC.