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Response of Two Hybrids of Tomato (*Lycupersicun esculentum* Mill) to Four Concentration of Humic Acid Fertilizers in Plastic House Condition

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Key Words:
Tomato, Hybrids, Humic acid fertilizers.

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ABSTRUCT

The experiment was conducted in greenhouse at the vegetable research farm of Horticulture Department, College of Agriculture/ University of Dohuk- Iraq, subsidy with the MCC-ZSVP organization, interior the plan of tomato crop production during the growing season of 2015-2016, to investigate the effects hybrids (Royal & Sandra) and humic acid (0, 0.4, 0.8 & 1.6) $g.l^{-1}$ on growth and yield of Tomato (*Lycopersicum esculentum*, Mill.) grown under plastic house condition. Results showed that Royal hybrid had significant increase in some vegetative (leaves area cm^2, plant high m and chlorophyll) and majority yield characters (No. of fruit $f.plant^{-1}$, plant yield $kg.plant^{-1}$, early yield and total yield $t.ha^{-1}$), while Sandra hybrid had significant increase in (fruit weight g and total acidity%), there were no significant effect of hybrids on yield characteristic (vitamin c, TSS, N, P and K) % in fruit . Spraying tomato with humic acid concentration significantly increase vegetative growth like (leaves area cm^2, plant high cm and chlorophyll %), and also humic acid increased quantitative and qualitative yield characters especially $0.8g.l^{-1}$ (No. of fruit $f.plant^{-1}$, plant yield $kg.plant^{-1}$, early yield $t.ha^{-1}$, total yield $t.ha^{-1}$, TSS% and N% in fruit), while $1.6g.l^{-1}$ of humic acid had higher increased K% in fruits, where as no significant differences occurred in (fruit weight g, vitamin C, total acidity % and P% in fruit).

استجابة اصناف الطماطة (*Lycopersicum esculentum* Mill.) لتسميد بهيوميك اسيد النامية تحت ظروف البيت البلاستيكى

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الكلمات المفتاحية:
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الخلاصــة

اجريت التجربة داخل البيوت البلاستيكية التابعة لقسم البستنة، كلية الزراعة \ جامعة دهوك – العراق بدعم من منظمة (MCC-ZSVP) ضمن برنامج تطوير زراعة نبات الطماطة. خلال الموسم الزراعي 2015–2016، لبيان تأثير الاصناف (رويال و) و الرش بهيوميك اسيد (0,4,0، 0,8 و 1,6)غم/لتر على نمو وانتاجية الطماطة (***Lycopersicum esculentum,* Mill.**) النامية تحت ظروف البيت البلاستيكي. بينت النتائج بان الصنف رويال ازدادت معنويا في اغلب صفات نمو الخضري (المساحة الورقية، طول النبات ونسبة الكلوروفيل) ومعظم صفات الحاصل (عدد الثمار لكل نبات، حاصل النبات الواحد، حاصل المبكر وحاصل الكلي) مقارنة بصنف ساندرا ، بينما صنف تفوق معنويا على صنف رويال في صفات (وزن الثمرة الواحدة ونسبة الحموضة الكلية)، ولم يكن للأصناف اي تأثير معنوي على صفات (فيتامين سي، TSS، ونسب N,P,K في الثمار). رش الطماطة بتراكيز الهيوميك اسيد ازدادت معنويا من صفات النمو الخضري (المساحة الورقية، طول النبات و نسبة الكلوروفيل)، وايضا سبب الرش بهيوميك اسيد زيادة معنوية في صفات الحاصل الكمية والنوعية خاصة تركيز 0,8 غم/لتر (عدد الثمار لكل نبات، حاصل النبات الواحد، حاصل المبكر ،حاصل الكلي طن/هكتار، نسبة المواد الصلبة الذائبة و نسبة النيتروجين في الثمار)، بينما 1,6 غم$^{-1}$ لتر من الهيومك اعطت نسبة اعلى من البوتاسيوم في الثمار، و لم يكن لهيوميك اسيد اي تأثير معنوي في صفات (وزن الثمرة الواحدة، فيتامين سي، نسبة الحموضة الكلية و نسبة الفسفور في الثمار).

INTRODUCTION:

Tomato (*Lycopersicon esculentum* Mill) belongs to solanaceae family. It's one of the most important vegetable in the world under field and green house conditions **(Kaloo, 1986).** Tomato is a majors components in the daily diet in many countries and constituted an important source of vitamins C 57% and vitamin A 25%, higher quantity of total sugar (2.5-4.5%), starch (0.6-1.2%) and minerals like potassium, calcium, sodium, magnesium, phosphorus, boron, manganese, zinc, copper, iron, etc. **(Jones, 2008).** The cultural operation which greatly influence tomato fruit yeilds are fertilizer application and use of improved hybrids. Humic acid is a commercial products which include many elements to improve the soil fertility and increased the availability of nutrient elements and consequently increase plant growth and yield. Humic acid particularly is used to ameliorate or reduce the negative effect of chemical fertilizers and some soil chemical. Some researchers have reported that, humic acid application led to a significant increase in soil organic matter improvement plant growth and crop production **(Hafez and Majda, 2003 and AL-Desuki, 2004**). Humic acid application promotes root growth and increase cell elongation in pea seedlings (*Pisum sativum*.) **(Hartwigsen and Evans, 2000). Atiyeh *et al*. (2002)** carried out two experiments to evaluate the effect of humic acid on tomato and cucumber growth. Their results showed that the growth of tomato and cucumber plants increased significantly, in terms of plant heights, leaf area, shoot and root dry weights. **Mikkelsen (2005)** found that the application of humic substances through drip irrigation enhanced tubers yield quantity, starch content and total soluble solids of potato (*Solanum tuberosum* L.). Treatment of tomato seeds with (0.01%) Potassium humate solution before planting for 24 hours increased the yield about (20-25 %). Also, Pre- planting seed treatment of cucumber by (0.01%) potassium humate solution for 24 hours increased the yield about (38 %) **(Gadimov *et al.*, 2007).** Plant growth increased with increasing concentrations of humic acids incorporated into the medium up to a certain proportion. The increase in height and number of leaves as organ mineral rates increased confirmed the role of organ minerals in promoting vigorous vegetative growth in fruits of melons and tomato **(Olaniyi *et al.*, 2006; Olaniyi and Ajibola, 2008). Habashy *et al.* (2008)** revealed that the application of micronutrients as chelating compounds for humic acid significantly increased the total chlorophyll of tomato plants (*Lycopersicon esculentum* Mill) grown under salinity conditions. Potassium-humate application led to increasing and improving growth characters of plants **(Türkmen *et al.*, 2005** on **pepper; Zaky *et al.*, 2006** on **broad bean and Karakurt *et al.*, 2009 on pepper). Asmaa and Hafez. (2010)** carried an experiment at EL-Nubaria, EL-Behira Governorate, Egypt, they used three levels of humic acid application (0, 2.38 and 4.8 kg humic acid/ha), that was added with irrigation water on potato (*Solanum tuberosum* L.) growth and productivity. The results showed that the vegetative growth characters nutritive value of potato tuber and were increased with increasing the level of humic acid application from 0 up to 4.8 kg humic acid/ha. **Mohsen Kazemi (2014)** foliar application of Ca (15 mM) + HA (30 ppm) resulted in the maximum TSS (5.14 °Brix), vitamin C (25.14), yield (25.36 $t.ha^{-1}$), fruit firmness (3.91 kg cm^{-2}). The aim of the present study was the effects of foliar spraying of HA on the growth, yield, fruit quality characteristics of tomato plant.

MATERIALS AND METHODS :

The experiment was carryout in plastic house (500 m^2), (10 × 50) m^2 subsidy with the MCC-ZSVP governor, interior the plan of tomato crop production. The plastic house was located at the Vegetable Research Farm, Horticultural Department, College of Agriculture, University of Duhok, Kurdistan region/Iraq, during the growing season of 2015-2016. The seeds of two tomato hybrids were taken (Royal, the germination percentage 99.9% and purity 90% and Sandra the germination percentage 85% and purity 99%). The seeds were planted in plastic pots (72) cavity, 1:1mixture of sandy soil : peat moss were preparative for planting. The seeds were planted in 23rd December 2015 by putting one seed in each cavity in the glasshouse. All cultural practices including fertilizing, weeding, soil softening around transplants and protective spraying were done to all treatments and the plants irrigated as those of tomato farm. The humic acid were sprayed on the

vegetative growth, four times. The first one was at fruit set, and it was repeated every two weeks between spray at three first fruit clusters colored. The surfactant agent Tween-80 was added to all solutions at a rate of 0.01% to reduce the surface tension of the solution and the control treatment spray by distilled water contain Tween-80.

The experiment comprised the effect of the two hybrids Royal and Sandra and four concentration of Humic acid (0, 0.4, 0.8 and 1.6) $g.L^{-1}$, the treatments was randomly arranged in a factorial experiment in a Randomized Complete Block design (RCBD). The number of experimental units were($2 \times 4 = 8$) with three replicates, the number of experiment was (24) units and the results were analyzed using the **SAS, 2007** program. Means value were compared using Duncan's multiple range test at 0.05 or 5% level **(AL-Rawi and Khalaf Alah, 2000).**

RESULTS AND DISSCOSION :

1-VEGETATEVE GROWTH CHARACTERS :

Leaf Area (cm^2) :

Data in table (1) indicated that significant effect of humic acid fertilizers and hybrids on leaves area, Royal hybrid had higher leaves area than Sandra hybrid, and the higher leaves area was resulted when spray tomato plant with $0.4g.L^{-1}$humic acid ($370.06cm^2$) as compared to control treatment ($268.49cm^2$). The interaction between humic acid and hybrids had significant effect, the interaction between Royal hybrid and $0.8g.L^{-1}$humic acid had higher result ($396.88cm^2$) as compared to other interaction.

Table (1):Effect of humic acid fertilizers and hybrids on leaves area (cm^2) of tomato.

Hybrids	Humic Acid $g.L^{-1}$				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	296.34 e	387.88 ab	396.88 a	368.82 bc	362.42 a
Sandra	240.64 f	352.24 bc	332.46 d	329.67 b	313.75 b
Means of Humic acid	268.49 c	370. 06 a	364.54 ab	349.25 b	

Means within a columns, row and there interaction followed with the same letters are not significantly differ from each other's according Duncan multiple range test at 5%level.

Plant high (m) :

Table (2) referred that significant effect of humic acid fertilizers and hybrids on leaves area, hybrid Royal had higher plant high (2.927m) than Sandra hybrid (0.857m), and the higher plant high was resulted when spray tomato plant with 1.6mg/L humic acid (1.949m) as compared to control treatment (1.795m), no significant effect occurred between humic acid concentration . The interaction between humic acid and hybrids had significant effect, the interaction between Royal hybrid and 1.6 $g.L^{-1}$humic acid had higher result (3.025m) as compared to other interaction.

Table (2):Effect of humic acid fertilizers and hybrids on plant high (m) of Tomato.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	2.705 b	2.989 a	2.989 a	3.025 a	2.927 a
Sandra	0.884 c	0.882 c	0.787 c	0.873 c	0.857 b
Means of Humic acid	1.795 b	1.935 a	1.888 ab	1.949 a	

Means within a column, row and their interactions followed with same letters are not significantly different from each other according to Duncan multiple rang test at 5% level.

Chlorophyll content in leaves (%) :

The data in table (3) show that significant effect of humic acid fertilizers and hybrids on chlorophyll in leaves, Royal hybrid had higher chlorophyll (53.59%) than Sandra hybrid (43.99%), and the higher chlorophyll was resulted in control treatment acid (51.80%). The interaction between humic acid and hybrids had significant effect, the interaction between Royal hybrid and control had higher result (57.77%) as compared to other interaction, but only not significant with Royal hybrid and 1.6 g.L^{-1}humic acid (55.47%).

Table (3):Effect of humic acid fertilizers and hybrids on chlorophyll content in leaves (%) of tomato.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	57.77 a	50.73 ab	50.40 ab	55.47 a	53.59 a
Sandra	45.83 bc	43.60 bc	42.27 c	44.27 bc	43.99 b
Means of Humic acid	51.80 a	47.17 ab	46.33 b	49.87 ab	

Means within column, row and there interaction followed with the same letters are not significantly differed from each others according to Duncan multiple ranges test at 5% level.

Dry weight of vegetative growth (%) :

The results in table (4) illustrated that there were no significant effect of hybrids and humic acid fertilizers on dry weight of vegetative growth, while there were significant effect occurred in the interaction treatments and the highest dry weight obtained between 0.4 g.L^{-1}humic acid and Royal hybrid (15.07%) compared with the interaction of control treatment and Sandra hybrid (13.03%).

Table (4):Effect of humic acid fertilizers and hybrids on dry weight of vegetative growth (%) of tomato.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	14.50 ab	15.07 a	14.77 a	14.90 a	14.81 a
Sandra	14.20 ab	14.43 ab	14.80 a	13.03 b	14.12 a
Means of Humic acid	14.35 a	14.75 a	14.78 a	13.97 a	

Means with a colum, row and there interaction followed with the same letter are not significantly different from each other according to Duncan multiple range test at 5%level.

It is evident from the previously mentioned results in table (1,2 and 3), that Royal hybrid superior to Sandra hybrid in plant height, leaves area and chlorophyll content in leaves, which is due to the genotype differences between the two hybrids and the increase in the vegetative growth of Royal hybrid due to the increase in absorption of the nutrient in the soil, or may be due to the differences in root system and RCEC which is differing among hybrids. These results are in harmony with those of **(AL-Sahaf *et al*., 2002); (Shareef, 2004); (Olaniyi *et al*., 2010), (Abdul-Rahman, 2011)** and **(Rasheed, 2013).** Those researchers carry out study on tomato hybrids, all of them found that there were differences occurred between hybrids on vegetative growth characters, each of one noble descent study. Also it is observed from the above mentioned results in table (1, 2, and 3) that a significant increase occurred in the leave area, plant high and total chlorophyll may be due to the role of humic acid that provides nutrients elements that share in bio efficiency and then increasing the growth **(Abdel-Mawgoud *et al*., 2007),** in addition humic acid assist soil the ventilation and this permit the root respiration and easily penetrate in the soil and then lead to increase root growth that positively increased the vegetative growth through water and nutrient absorption **(Garcia *et al* ., 2008).**

David *et al*. (1994) have reported that humic substance promoted growth and more mineral nutrient uptake of plant due to the better-developed root system. Increased in the plant height could be due to the application of humic acid since the acid has the ability to provide an acidic medium and correlate with positive ion to form a complex which is very important for trace elements (micronutrients) as these micronutrients are sized (cohered) tightly and protected from precipitation by these compound. The humic acid is also a source of nitrogen hence increasing the availability of nutrients **(Phelps, 2000).**

2-QUANTITATIVE YIELD CHARACTERS :

Number of fruit per plant(f.plant^{-1}) :

Results in table (5) showed that significant effect of humic acid fertilizers and hybrids on leaves area, Royal hybrid had higher No. of fruit than Sandra hybrid, The higher No. of fruit was resulted when spray tomato plant with 0.8 g.L^{-1}humic acid (16.35f plant^{-1}) as compared to control treatment (14.67f plant^{-1}). The interaction between humic acid and hybrids had significant effect, the interaction between Royal hybrid and 0.8 g.L^{-1}humic acid had higher result (22.20f.plant^{-1}) as compared to other interaction.

Table (5):Effect of humic acid fertilizers and hybrids on number of fruit per plant(f. plant^{-1})of tomato.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	20.07 c	21.40 b	22.20 a	21.03 b	21.18 a
Sandra	9.27 e	10.4 d	10.50 d	9.50 e	9.92 b
Means of Humic acid	14.67 d	15.90 b	16.35 a	15.27 c	

Means within culomn, row and there interaction follow with the same letter are not significantly different from each other according to Duncan multiple range test at 5%level.

Fruit weight (g):

Data in table (6) revealed that the hybrids significantly affected on the fruit weigh of tomato, Sandra hybrid had the higher fruit weight (20.713g) than Royal hybrid (121.40g). The humiac acid fertilizers had no significant effect on the fruit weight. The interaction effect between hybrids and humic acid affected fruit weight, the interaction between Sandra hybrid and 0.8 $g.L^{-1}$of humic had the highest value reached (207.40g) as compare to other interaction.

Table (6):-Effect of Humic acid fertilizers and hybrids on fruit weight (g) of tomato.

Hybrids	Humic Acid $g.L^{-1}$				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	112.61 b	124.04 b	132.93 b	116.01 b	121.40 b
Sandra	198.58 a	204.61 a	207.40 a	204.23 a	203.71 a
Means of Humic acid	155.59 a	164.32 a	170.17 a	160.12 a	

Means within a column, row and there interaction followed with the same letter are not significantly different from each other according to Duncan multiple ranges test at 5%level.

Plant yield ($kg.plant^{-1}$):

The results in table (7) shows that the hybrids and humic significantly effect on plant yield, Royal hybrid and 0.8 $g.L^{-1}$humic had the higher value reached (2.58 and 2.56) $kg.plant^{-1}$ respectively. As the interaction effect shows that interaction between Royal hybrid and 0.8 $g.L^{-1}$humic significantly increase plant yield (2.95$kg.plant^{-1}$) compared to other interaction.

Table (7):Effect of humic acid fertilizers and hybrids on plant yield kg. $plant^{-1}$ of tomato.

Hybrids	Humic Acid $g.L^{-1}$				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	2.26 cd	2.65 b	2.95 a	2.44 c	2.58 a
Sandra	1.83 f	2.12 de	2.18 d	1.94 ef	2.02 b
Means of Humic acid	2.05 d	2.39 b	2.56 a	2.19 c	

Means within a column, row and there interaction followed with the same letters are not significantly different from each others according to Duncan multiple range test at 5% level.

Early yield ($t.ha^{-1}$) :

Table (8) indicated that the hybrids had significantly affected on early yield of tomato plant, that Royal hybrid had the higher yield (54.25 $t.ha^{-1}$). The humic fertilizers also significant affected on early yield and the 0.8 $g.L^{-1}$humic gave the highest value (55.31$t.ha^{-1}$) and there are no differences between above concentration and the 0.4 $g.L^{-1}$humic acid (51.68 $t.ha^{-1}$). The interaction effected significantly and the interaction between Royal hybrid and 0.8 $g.L^{-1}$humic had the higher yield than the other interaction reached (66.69 $t.ha^{-1}$).

Table (8):Effect of humic acid fertilizers and hybrids on early yield t.ha^{-1}tomato.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	42.83 bc	61.61 a	66.69 a	45.90 b	54.25 a
Sandra	34.80 c	41.75 bc	43.98 bc	39.24 bc	39.94 b
Means of Hiumic acid	38.81 b	51.68 a	55.33 a	42.57 b	

Means within a column, row and there interactions followed with the same letters are not significantly different from each others according to Duncan multiple ranges test at 5% level.

Total yield (t.ha^{-1}) :

Table (9) below indicated that the hybrids had significantly affected on total yield of tomato plant, Royal hybrid had the higher yield (151.12 t.ha^{-1}). The humic fertilizers also significant affected on total yield and the 0.8g.L^{-1}humic gave the highest value (150.38 t.ha^{-1}). The interaction affected significantly and the interaction between Royal hybrid and 0.8 g.L^{-1}humic had the higher yield than the other interaction reached (173.07 t.ha^{-1}).

Table (9):Effect of humic acid fertilizers and hybrids on total yield t.ha^{-1}of tomato.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	132.59 cd	155.66 b	173.07 a	143.15 c	151.12 a
Sandra	107.56 f	124.57 de	127.70 d	113.62 ef	118.36 b
Means of Hiumic acid	120.07 d	140.12 b	150.38 a	128.38 c	

Means within a column, row and there interactions followed with the same letters are not significantly different from each others according to Duncan multiple range test at 5%level.

Yields is well known as a complicated phenomenon controlled by many genes and expression of such genes is continuous in nature **(Sheah, 2000**). Royal hybrid surpassed the Sandra hybrid in yield characters which may be due to the good foliage or vegetative growth of the Royal hybrid (tables 1, 2 and 3) which reflected to the yield characters (tables 5, 7, 8 and 9). Improved yield could be related to the increasing of soil aggregates due to the high content of the organic matter in humic substances application. It is believed that humic acid being a poly functional molecule (**Schnitzer and Khan, 1972 and Sposito, 1989)** attracts micronutrients cations, preventing them from leaching and releasing them slowly to the plants **(Emanuele, 1997).** Humic acid have several ways of impacting the plant development. First, humic acids perform the physiological function of, and in fact, are growth stimulators, stimulating the root development, plant growth (table 1, 2 and 3) and the chlorophyll content improve the intake of nutrients from the soil, and reduce the intensity of chemical absorption. **(Jariene *et al*., 2007).** Humic acid can, through the ability to form complexes with metal ions and hydrous oxides, affect the availability of nutrients to plant roots and possibly facilitate the movement of metal ions, such as iron, within the plant. Additionally, humic acid could improve the chemical properties of soil by counteracting soil alkalinity **(Ghabbour and Davies, 1998).** Studies indicate that humic acid was in general not only beneficial to shoot and root growth but also to the nutrient uptake of vegetables crops **(Akinremi *et al*., 2000; Dursun *et al*., 2002; Cimrin and Yalmaz, 2005 and Padem *et al*., 1997).**

3- QULITATIVE YIELD CHARACTERS.

Vitamin C (mg.100ml^{-1} juice) :

Table (10) shows that no significant difference obtained between hybrids and the humic acid concentration also not affected on the vitamin C in fruit, the interaction between hybrids and humic had non significant effect on the vitamin C in fruit.

Table (10):-Effect of humic acid fertilizers and hybrids on vitamin C mg.100ml^{-1} juice.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	2.47 a	3.13 a	3.17 a	2.57 a	2.83 a
Sandra	2.37 a	2.63 a	3.17 a	2.93 a	2.78 a
Means of Humic acid	2.42 a	2.88 a	3.17 a	2.75 a	

Means within a column, row and there interactions followed with the same letter are not significantly different from each others according to Duncan multiple range test at 5% level.

Total acidity in fruits (%):

The data in table (11) indicated that significant effect of hybrids on total acidity in the fruit, Sandra hybrid had the higher acidity (6.23%) than Royal hybrid (5.51%). No significant effect had observed between humic acid concentration. In this table shows that the interaction between hybrids and humic acid significant effect on the acidity and the higher value had observed between Sandra hybrid and 0.4 g.L^{-1}humic (6.83%).

Table (11):- Effect of humic acid fertilizers and hybrids on total acidity (%).

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	5.53 bc	5.03 c	4.87 c	5.17 c	5.15 b
Sandra	5.93 abc	6.83 a	5.50 bc	6.67 ab	6.23 a
Means of Humic acid	5.73 a	5.93 a	5.18 a	5.92 a	

Means within column, row and there interaction followed with the same letter are not significantly different from each others according to Duncan multiple ranges test at 5% level.

Total Soluble Solid (TSS%) :

Data in the table below (12) illustrated that no significant effect of hybrids on the TSS in fruits, the humic concentration significantly increased the TSS in fruits the highest value (5.00%) obtained when tomato plant sprayed with 0.8 g.L^{-1}humic. There were no significant effect occurred between interaction of hybrids and humic acid.

Table (12):-Effect of humic acid fertilizers and hybrids on TSS.

Hybrids	Humic Acid g.L^{-1}				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	4.33 a	4.67 a	5.00 a	4.00 a	4.50 a
Sandra	4.67 a	4.67 a	5.00 a	4.00 a	4.58 a
Means of Humic acid	4.50 ab	4.67 ab	5.00 a	4.00 b	

Means within column, row and there interactions followed with the same letters are not significantly different from each others according to Duncan multiple ranges test at 5% level.

Nitrogen percent in fruits(%).

Data in table (13) shows that the hybrids had non affected on N % in tomato fruit. But humic acid concentration significant effect on N% in fruit, the 0.8 g.L^{-1}humic had the highest value reached (0.867%) and the lowest had occurred in control (0.467%). The data between interaction significantly effect on N%, the highest on was (0.900%) between Royal hybrid and 0.8 g.L^{-1}humic.

Table (13):- Effect of humic acid fertilizers and hybrids on N % in fruit of tomato.

Hybrids	Humic Acid				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	0.567 bc	0.300 c	0.900 a	0.700 ab	0.617 a
Sandra	0.367 c	0.733 ab	0.833 ab	0.400 c	0.583 a
Means of Humic acid	0.467 b	0.517 b	0.867 a	0.550 b	

Means within column, row and there interactions followed with the same letters are not significantly different from each others according to Duncan multiple ranges test at 5% level.

Phosphorus percent in fruits (%):

Data in table under shows that the hybrids had non affected on P % in tomato fruit. And also humic acid concentration not significant effect on P% in fruit. The 0.8 g.L^{-1}humic and hybrid B had the highest value reached (0.537%) as the interaction effect between them table (14).

Table (14):-Effect of humic acid fertilizers and hybrids on P% in fruits of tomato.

Hybrids	Humic Acid				Means of Hybrids
	0	0.4	0.8	1.6	
Royal	0.0450 b	0.0403 bc	0.0363 c	0.0453 b	0.0418 a
Sandra	0.0413 bc	0.039 bc	0.537 a	0.0453 b	0.0448 a
Means of Humic acid	0.0432 a	0.0397 a	0.0450 a	0.0453 a	

Means within a column, row and there interactions followed with the same letters are not significantly different from each others according to Duncan multiple ranges test at 5%level.

Potassium percent in fruit (%):

Table (15) revealed the there were no significant effect of hybrids on K% in tomato fruits, but the humic acid significantly increase K % and the 1.6 g.L^{-1}humic had the highest K% (11.67%). The interaction between hybrids and humic significant effect on K%, the interaction between Royal

hybrid and 1.6 g.L^{-1}humic and the Sandra hybrid and the 0.8 g.L^{-1}humic had the highest same value (14.00 &14.00)% respectively.

Table (15):- Effect of humic acid fertilizers and hybrids on K% in fruit of tomato.

Hybrids	Humic Acid				Means of Hybrids
	1	2	3	4	
Royal	11.67 ab	7.67 b	8.00 b	14.00 a	10.33 a
Sandra	8.67 b	9.33 b	14.00 a	9.33 b	10.33 a
Means of Humic acid	10.17 ab	8.50 b	11.00 ab	11.67 a	

Means within column, row and there interactions followed with the same letters are not significantly different from each others according to Duncan multiple ranges test at 5% level.

It is conspicuous from the previously mentioned results that there are differences between the two hybrids in qualitative yield characters. Royal hybrid had a high total acidity than the hybrid, may be due to the genotype differences between two hybrids. And also may be due to the superiority of Royal hybrid in plant, early and total yield (table, 7, 8 and 9) and vegetative characters (table 1, 2 and 3) compared to the Sandra hybrid which increased absorption of nutrient in the soil. These results agree with those of **Abdul-Rahman (2011) and Aboutalebi *et al*.(2012) .**It is observed from the mentioned results that a significant increased occurred in, total soluble solids, N% and K% content. The improvement of fruit quality may be attributed to be better growth of the plant (table 1, 2, and 3) at different rate of humic acid. The organic fertilizers are considered the conceder source of macro and micro elements that are necessary for plant growth and proved the soil with humus that enhance the physical characters of soil and their ability to absorption water and restored it, also its reduce the loss of nutrient elements and increase the activity of microorganisms, and gave high yield with good qualities **(Molivko, 2001 and Grandy *et al*., 2002),** or the increase in qualitative character of tomato may be due to the increase in photosynthesis products in plants, or due to high fruit weight, or may be due to the effect of humic acid that make increase in the total soluble solid and ascorbic acid, because of their effect on increasing the leaf area (table, 1) and the efficiency of photosynthesis **(Jensen, 2004).**

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