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Effect of Humic and Fulvic Acid on Growth and Yield of two Okra cultivars grown in Wadi El-Tor, south Sinai

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ABSTRACT

A field experiment was conducted under the open field conditions of a privet Bedouin farm in Wadi El-Tor, south Sinai governorate, during two seasons 2016 and 2017 to study the influences of different rates of Humic (3 and 5g /L)and Fulvic acid (1.5 and 3 g/L) and combination between them at the rate of 1.5 g/L Fulvic + 3 g/L Humic and 3 g/L Fulvic + 5 g/L Humic acid on growth, yield and N, P and K content of two Okra (*Abelmoschus esculentus*) cultivars (Balidy and Poorvi).

The results showed that high rate of both Fulvic acid and humic acid given higher values of plant height, number of leaves and number of branches as well as fresh and dry weightof leaves and/or branches. As using 5 ml/L of Humic acid also increased significantly fruit set, yield and fruit weight of both cultivars. Also, the high level of humic and Fulvic acid increased significantly of N, P and K content in both cultivars leaves. Poorvi hybrid had great effect on yield and nutrients content of compared with Balidy cultivar at two seasons.

***Keywords*:** Okra, Humic and Fulvic Acid, growth, yield

Introduction

Okra (*Abelmoschus esculentus* L.) of the family Malvaceae is a summer vegetable cultivated in tropical and subtropical regions throughout the world regions. Despite the green immature pod which is cooked and used as vegetable, it is a good source of vitamin A, B and C, minerals, proteins and iodine (Kirn *et al.* 2010 and Kumar *et al.* 2015). Okra plays a vital role in human diet (Saifullah & Rabbani 2009).

Consumption of young immature okra pods is important as fresh fruits, and it can be consumed fried, boiled and cooked (Akintoye *et al.* 2011). Each 100 g of pods contains 88.6 g water, 36 kcal of energy, 2.10 g protein, 8.20 g carbohydrate, 0.20 g fat, 1.70 g fiber, 84.00 mg Ca, 90.00 mg P, 1.20 mg Fe, 185.00 µg β-carotene, 0.08mg riboflavin, 0.04 mg thiamin, 0.60 mg niacin and 47.00 mg ascorbic acid.

Okra diver's genotypes respond different to environmental conditions which result variation in their growth, yield and quality (Dash and Misra 1995). For better plant growth and higher yield it is essential to cultivate high yielding varieties with improved cultural practices and sufficient nutrients supply.

Fulvic acid is a bi-product of humic acid. Humic acid is extracted from any material containing well-decomposed organic matter - soil, coal, composts, etc. As humic material is decomposed by living microbes, these microbes create the most biologically complex organic compound, Fulvic acid. Fulvic acid is low molecular weight and is biologically very active. Because of its low molecular weight, it has the necessity and ability to readily bond minerals and elements into its molecular structure causing them to dissolve and become mobilized Fulvic complexes.

Humic acid is rich in carboxyl, hydroxyl, and carbonyl groups as well as in phenols, quinones and semi-quinones (Bravo, 1998 and Yoshino, 1998). The stimulatory effects of humic substances have been directly correlated with increasing of some micronutrients uptake such as Fe, Zn and Mn (Chen and Aviad, 1990). Humic acid application to soils boost up biological processes in soil and hold the

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nutrients in easily exchangeable form to minimize their leaching from soil profile with peculating water (Brady and Weil, 2008). Addition of humic acid increases the uptake of both micro and macro nutrients and led to hormonal activities and improving nutritional status, it shows anti-stress affect in plant body when soil pH and temperature are unfavorable for plant growth (Kulikova *et al.*, 2005).

The present study was carried out to examine the effect of humic acid and Fulvic acid in enhancing the growth and yield of two okra cultivars.

Materials and Methods

The experiments was carried out under the open field conditions of a privet Bedouin farm in Wadi El-Tor, south Sinai governorate, during two successive seasons 2016 and 2017.

Split plot design was used in the field layout of these experiments. Okra cultivars was arranged in the main plots and organic material (Humic and Fulvic acid) was arranged in sub- plot and replicated three times.

Okra; Balidy and poorvi hybrid were sown in main plots while organic treatments i.e. Fulvic acid (aded at the rate of 1.5 and 3g/L) and humic acid (at the rate of 3 and 5 g/L) were arranged in sub-plot and added once a week with irrigation water through drip irrigation system.

Agricultural operation practices other than treatments were carried out according to the recommendation of Ministry of Agriculture and Land Reclamation (MILAR) in Egypt. Seeds were soaked before seeding for 24 hrs in distilled water to encourage the germination rate. Once the plants emergence occurred, thinning was carried out where more than one seedling was emerged to maintain the required planting density.

Data Recorded:

Plant Growth: Random samples of five plants were taken at 60 days after sowing from each treatment to measure plant growth parameters i.e. plant height (cm), number of leaves, number of branches and/or fresh and dry weights of leaves, branches / plant (g).

Pod Yield and Quality: Pod yield at marketable stage were harvested weekly. At harvest time the early and total pod yield, as well as pod quality (length, diameter, weight and protein content) were recorded.

Chemical Content: Chemical analysis of Okra leaves was carried out to determine mineral contents (N, P, and K). The plant materials were dried in an oven at 70 °C until a constant mass was reached and then they were grounded for chemical analysis. Total nitrogen was determined using the micro-Kjeldahl method (Kacar, 1972). Phosphorus was determined spectrophotometrically according to Troug and Meyer, 1939. Moreover, K was determined by atomic absorption spectrophotometer using perkin Elmer Model 370A as described by Chapman and Pratt (1978).

Experimental Design and Statistical Analysis:

Split plot design with three replicates was followed; Humic acid rates were arranged in main plots, while bio-stimulators solutions rates were distributed in the sub plots. Data were subjected to the analysis of variance (ANOVA) to compare the effects of application treatments (Snedicor and Cochran, 1980). When significant differences occurred, the means were separated using least significant difference test (LSD, $P < 0.05$).

Results and Discussion

Vegetative growth:

Effect of okra cultivars:

The effect of okra cultivars on vegetative growth was showed in Table (1). Data showed that Balidy cultivar recorded the highest plant highest, number of leaves, fresh and dry weight of leaves and whole plant, while Poorvi hybrid recorded the highest number of branches and fresh and dry weight of branches. These results were true in both growing seasons.

Table 1: Effect of okra cultivars on vegetative growth:

Variety	Plant height (cm)	Number of leaves	Number of branches	Fresh weight (gm)			Fresh weight (gm)		
				Leaves	Branches	Total	Leaves	Branches	Total
First season									
Balidy	77.08	32.17	3.37	56.75	59.03	115.78	24.85	14.51	39.36
Poorvi	60.66	21.30	4.07	33.51	39.69	73.20	15.32	20.47	35.80
L.S.D. 0.05	0.27	0.23	0.08	0.59	0.38	0.27	0.27	0.73	0.77
Second season									
Balidy	81.22	33.60	3.54	58.74	60.87	119.60	25.98	15.26	41.23
Poorvi	65.91	22.98	4.35	35.59	41.92	77.52	16.72	22.27	38.99
L.S.D. 0.05	0.11	0.29	0.10	0.61	0.52	1.13	0.32	0.49	0.52

Effect of humic and fulvic acid:

Data in table (2) show the effect of applying of fulvic and humic acid on vegetative growth of okra plants. Results clearly indicated that the application of the combination of Fulvic acid and Humic acid at different rate was significantly increased all growth parameters compared to control. Results also clear that the highest values of vegetative growth (plant height, number of leaves and branches as well as fresh and dry weight of leaves and / or branches) were recorded with okra plant which received fulvic (3 g/L) and humic acid (5 g/L) followed by those received the combination of fulvic (1.5 g/L) and humic acid (3 g/L). But the lowest values were recorded with the control.

Table 2: Effect of humic and fulvic acid application on vegetative growth of okra plants.

Organic fertilizers g/L	Plant height (cm)	Number of leaves	Number of branches	Fresh weight (gm)			Dry weight (gm)		
				leaves	branches	total	leaves	branches	total
First season									
Control	60.19	21.61	1.63	29.02	32.91	61.93	10.28	11.11	21.38
Fulvic 1.5	64.51	23.81	2.58	39.04	44.26	83.31	15.43	13.43	28.86
Fulvic 3	67.01	25.44	3.05	42.45	46.46	88.90	18.43	15.38	33.81
Humic 3	70.10	27.01	3.73	47.11	49.97	97.08	20.15	17.36	37.51
Humic 5	71.44	28.30	4.59	49.33	52.68	102.01	22.68	19.27	41.95
Fulvic 1.5 + Humic 3	73.41	29.48	4.87	52.37	56.13	108.50	25.49	21.38	46.87
Fulvic 3 + Humic 5	75.46	31.53	5.58	56.59	63.10	119.69	28.17	24.52	52.69
L.S.D. 0.05	1.58	0.75	0.41	1.34	1.53	1.81	1.21	0.64	1.23
Second season									
Control	64.32	22.33	1.73	30.50	34.21	64.71	11.15	11.90	23.05
Fulvic 1.5	68.75	25.24	2.79	40.69	45.99	86.68	16.27	14.45	30.73
Fulvic 3	71.71	26.91	3.25	44.31	48.45	92.77	19.62	16.53	36.15
Humic 3	74.54	28.48	3.83	49.26	51.87	101.13	21.25	18.47	39.72
Humic 5	76.47	30.44	4.87	51.66	55.10	106.76	24.20	20.83	45.03
Fulvic 1.5 + Humic 3	78.47	31.11	5.17	54.79	58.16	112.95	26.90	22.74	49.63
Fulvic 3 + Humic 5	80.72	33.54	5.97	58.95	65.97	124.92	30.06	26.40	56.47
L.S.D. 0.05	1.41	0.88	0.36	1.23	1.59	1.86	1.30	0.76	1.36

Effect of the interaction between cultivars and humic and fulvic acid on vegetative growth of okra plants:

Data in Table (3) show the effect of the interaction between cultivars and humic and fulvic acid application on vegetative growth of okra plants i. e. plant height, number of leaves and branches as well as fresh and dry weight of leaves and / or branches. Result showed that all vegetative growth of okra plants was significantly affected by the interactions between cultivars and humic and fulvic acids applications. The highest values were recorded with Balidy cultivar with adding the combination of Fulvic acid (3 g/L) and Humic acid (5 g/L) followed by those receiving fulvic (1.5 g/L) and humic acid (3 g/L).While the lowest values was recorded with the Poorvi hybrid without adding fulvic or humic acids. However, the number of branches were recorded the highest values with Poorvi hybrid with adding the combination Fulvic acid and Humic acids. Results also showed that the combination

of Fulvic acid and Humic acid improved vegetative growth of Poorvi hybrid as compared with adding Fulvic acid or Humic acid separately.

Table 3: Effect of the interaction between cultivars and humic and fulvic acid on vegetative growth of okra plants:

Interaction treatments		Plant height (cm)	Number of Leaves	Number of Branches	Fresh weight (gm)			Dry weight (gm)		
Variety	Organic fertilizers				Leaves	Branches	Total	Leaves	Branches	Total
				First season						
	Control	67.73	26.39	1.77	29.75	34.70	64.45	10.90	10.33	21.23
	Fulvic 1.5	72.29	30.42	2.53	46.97	55.25	102.22	19.68	11.01	30.69
	Fulvic 3	75.53	31.72	2.77	52.03	57.35	109.38	22.98	12.26	35.24
Balidy	Humic 3	77.67	32.32	3.47	60.60	59.50	120.10	25.37	13.93	39.29
	Humic 5	78.91	33.51	4.00	63.83	62.96	126.79	27.98	15.83	43.81
	Fulvic 1.5 + Humic 3	82.66	34.70	4.23	68.46	66.83	135.29	31.65	17.65	49.30
	Fulvic 3 + Humic 5	84.80	36.17	4.80	75.60	76.60	152.20	35.42	20.55	55.97
	Control	52.64	16.83	1.50	28.28	31.12	59.40	9.65	11.88	21.53
	Fulvic 1.5	56.73	17.20	2.63	31.12	33.28	64.39	11.18	15.85	27.03
	Fulvic 3	58.50	19.15	3.33	32.86	35.56	68.42	13.88	18.50	32.38
Poorvi	Humic 3	62.52	21.70	4.00	33.62	40.43	74.05	14.93	20.79	35.72
	Humic 5	63.97	23.08	5.17	34.82	42.40	77.22	17.37	22.72	40.09
	Fulvic 1.5 + humic 3	64.15	24.27	5.50	36.28	45.42	81.70	19.33	25.10	44.44
	Fulvic 3 + humic 5	66.11	26.88	6.35	37.58	49.60	87.18	20.92	28.48	49.40
L.S.D. 0.05		N. S.	1.06	0.59	1.90	2.16	2.57	1.71	0.90	1.73
				Second season						
	Control	71.12	26.78	1.86	31.31	35.41	66.72	11.67	10.98	22.65
	Fulvic 1.5	76.23	31.64	2.66	48.38	56.91	105.28	20.47	11.45	31.92
	Fulvic 3	79.30	33.32	2.94	54.03	59.57	113.60	24.07	13.01	37.08
Balidy	Humic 3	81.88	33.74	3.54	62.42	61.29	123.70	26.38	14.48	40.87
	Humic 5	83.52	35.51	4.20	66.08	65.18	131.26	29.30	16.79	46.10
	Fulvic 1.5 + Humic 3	86.80	36.08	4.55	71.08	68.51	139.59	32.92	18.36	51.28
	Fulvic 3 + Humic 5	89.70	38.12	5.04	77.87	79.20	157.07	37.03	21.71	58.74
	Control	57.52	17.88	1.61	29.70	33.01	62.70	10.62	12.83	23.45
	Fulvic 1.5	61.27	18.84	2.92	33.01	35.07	68.08	12.08	17.45	29.53
	Fulvic 3	64.11	20.49	3.57	34.60	37.34	71.94	15.16	20.05	35.21
Poorvi	Humic 3	67.19	23.22	4.11	36.10	42.46	78.55	16.13	22.45	38.58
	Humic 5	69.42	25.37	5.54	37.23	45.02	82.25	19.09	24.87	43.96
	Fulvic 1.5 + Humic 3	70.15	26.13	5.79	38.50	47.82	86.32	20.88	27.11	47.99
	Fulvic 3 + Humic 5	71.74	28.96	6.90	40.03	52.75	92.78	23.09	31.10	54.19
L.S.D. 0.05		N. S.	1.25	0.51	1.74	2.25	2.63	1.84	1.07	1.92

Mineral content

Effect of cultivar on minerals content of okra leaves:

Data in Table (4) show that effect of cultivar on okra leaves content of N, P, K. Results clear that the highest values were recorded with Poorvi hybrid. The content of potassium in the first season as well as nitrogen and phosphorus in the second season were also increased in the second season but this increase was failed to reach the level of significantly.

Effect of humic and fulvic acid on minerals content of okra leaves:

Data in Table (5) show that effect of humic and fulvic acid on okra leaves content of N, P and K. Results reveled that the highest values were recorded with application of the combination of Fulvic acid (3 g/L) and Humic acid (5 g/L) followed by those receiving fulvic (1.5 g/L) and humic acid (3 g/L).While the lowest values was recorded with the control. But the content of phosphorus in the second season were failed to reach the level of significantly.

Table 4: Effect of cultivar on minerals content of okra leaves

Variety	N %	P %	K %
	First season		
Balidy	0.79	0.10	0.37
Poorvi	0.83	0.11	0.37
L.S.D. 0.05	0.019	0.006	N.S.
	Second season		
Balidy	0.95	0.14	0.41
Poorvi	0.96	0.15	0.44
L.S.D. 0.05	N.S.	N.S.	0.005

Table 5: Effect of humic and fulvic acid on minerals content of okra leaves

Organic fertilizers (g/L.)	N	P %	K %
	First season		
Control	0.71	0.09	0.36
Fulvic 1.5	0.81	0.10	0.36
Fulvic 3	0.83	0.12	0.37
Humic 3	0.77	0.09	0.37
Humic 5	0.79	0.12	0.38
Fulvic 1.5 + humic 3	0.86	0.11	0.38
Fulvic 3 + humic 5	0.90	0.13	0.40
L.S.D. 0.05	0.063	0.017	0.012
	Second season		
Control	0.91	0.14	0.38
Fulvic 1.5	0.95	0.14	0.41
Fulvic 3	0.97	0.15	0.46
Humic 3	0.90	0.14	0.39
Humic 5	0.91	0.14	0.44
Fulvic 1.5 + Humic 3	1.00	0.15	0.43
Fulvic 3 + Humic 5	1.03	0.16	0.49
L.S.D. 0.05	0.082	N.S.	0.023

Effect of the interaction treatments on minerals content of okra leaves:

Results in Table (6) shows the effect of the interaction treatments between variety and humic and fulvic acid on minerals content of okra leaves. Results clear that the minerals content (NPK) of okra leaves were not significantly affected by the interaction between variety and humic or fulvic acid, except for K% in the second season. However, the highest values were recorded with Poorvi hybrid which received the combination of Fulvic acid (3 g/L) and Humic acid (5 g/L) followed by those receiving fulvic (1.5 g/L) and humic acid (3 g/L).While the lowest values was recorded with the Balidy cultivar without adding fulvic or humic acids.

Yield and its quality:

Effect of cultivar:

Data in Table (7) show the effect of okra cultivar on pod yield and its quality. Results showed that Poorvi hybrid gave the highest early yield and total yield (ton/fed.) as well as pod length (cm) and protein content. However, Balidy cultivar gave the highest pod diameter and pod weight. These results were true in both growing seasons.

Effect of humic and fulvic acid on pods yield and its quality:

Data in Table (8) show the effect of humic and fulvic acid on pod yield and its quality. Results showed that the combinations of Fulvic acid (3 g/L) and Humic acid (5 g/L) gave highest values of early and total yield as well as pod length, diameter, pod weight and protein content, followed by fulvic treatment at level of 1.5 g/L and humic acid at the level of 3 g/L. But the lowest values was recorded with the control plants. These results were true in both growing seasons.

Table 6: Effect of the interaction treatments between variety and humic and fulvic acid on minerals content of okra leaves:

Interaction treatments		N %	P %	K %
Variety	**Organic fertilizers (g/L.)**			
		First season		
	Control	0.68	0.08	0.35
	Fulvic 1.5	0.80	0.10	0.36
	Fulvic 3	0.82	0.11	0.37
Balidy	Humic 3	0.76	0.09	0.37
	Humic 5	0.78	0.11	0.37
	Fulvic 1.5 + Humic 3	0.84	0.11	0.38
	Fulvic 3 + Humic 5	0.88	0.12	0.39
	Control	0.75	0.10	0.36
	Fulvic 1.5	0.82	0.10	0.36
	Fulvic 3	0.85	0.13	0.37
Poorvi	Humic 3	0.78	0.10	0.37
	Humic 5	0.80	0.12	0.38
	Fulvic 1.5 + Humic 3	0.87	0.11	0.38
	Fulvic 3 + Humic 5	0.91	0.14	0.40
L.S.D. 0.05		N.S.	N.S.	N.S.
		Second season		
	Control	0.89	0.13	0.38
	Fulvic 1.5	0.95	0.14	0.40
	Fulvic 3	0.96	0.15	0.43
Balidy	Humic 3	0.90	0.13	0.38
	Humic 5	0.91	0.14	0.41
	Fulvic 1.5 + Humic 3	1.00	0.15	0.42
	Fulvic 3 + Humic 5	1.03	0.16	0.46
	Control	0.94	0.14	0.38
	Fulvic 1.5	0.95	0.14	0.41
	Fulvic 3	0.97	0.15	0.49
Poorvi	Humic 3	0.90	0.14	0.39
	Humic 5	0.92	0.14	0.46
	Fulvic 1.5 + Humic 3	1.01	0.15	0.43
	Fulvic 3 + Humic 5	1.04	0.16	0.52
L.S.D. 0.05		N. S	N.S.	0.032

Table 7: Effect of okra variety on pods yield and its quality.

Variety	Yield (ton/fed.)		Pod quality			
	Early yield	**Total yield**	**Length (cm)**	**Diameter (cm)**	**Weight (g)**	**Protein content**
			First season			
Balidy	0.664	5.951	4.04	2.51	4.98	2.82
Poorvi	0.952	6.349	4.70	1.51	3.19	4.49
L.S.D. 0.05	0.004	0.192	0.05	0.04	0.20	0.02
			Second season			
Balidy	0.689	6.199	4.16	2.53	5.06	2.92
Poorvi	1.007	6.742	4.81	1.55	3.29	4.74
L.S.D. 0.05	0.022	0.210	0.05	0.01	0.16	0.03

Table 8: Effect of humic and fulvic acid on pods yield and its quality.

Organic fertilizers (g/L.)	Yield (ton/fed.)		Pod quality			
	Early yield	Total yield	Length (cm)	Diameter (cm)	Weight (g)	Protein content
			First season			
Control	0.739	4.594	3.74	1.67	2.03	3.03
Fulvic 1.5	0.782	5.326	3.88	1.74	2.52	3.25
Fulvic 3	0.797	5.917	3.93	1.85	3.42	3.56
Humic 3	0.819	6.085	3.98	2.00	3.59	3.52
Humic 5	0.828	6.492	4.26	2.11	4.61	3.79
Fulvic 1.5 + Humic 3	0.839	6.978	4.84	2.28	5.98	3.78
Fulvic 3 + Humic 5	0.854	7.661	5.97	2.43	6.45	4.65
L.S.D. 0.05	0.011	0.403	0.27	0.11	0.40	0.16
			Second season			
Control	0.746	4.828	3.84	1.64	2.11	3.16
Fulvic 1.5	0.805	5.611	4.00	1.77	2.63	3.43
Fulvic 3	0.841	6.211	4.05	1.88	3.47	3.71
Humic 3	0.857	6.389	4.07	2.04	3.67	3.67
Humic 5	0.887	6.831	4.38	2.15	4.69	4.00
Fulvic 1.5 + Humic 3	0.883	7.337	4.97	2.32	6.09	3.97
Fulvic 3 + Humic 5	0.916	8.087	6.09	2.48	6.57	4.84
L.S.D. 0.05	0.028	0.450	0.28	0.10	0.38	0.19

Effect of the interaction treatments on pods yield and its quality:

Data in Table (9) show the effect of the interaction treatments on pod yield and its quality. Results clear that Poorvi hybrid which received the combinations of Fulvic acid (3 g/L) and Humic acid (5 g/L) gave highest values of early and total yield as well as pod length, diameter and protein content, followed by those received fulvic (1.5 g/L) and humic acid (3 g/L). However, Balidy cultivar which received the combinations of Fulvic acid (3 g/L) and Humic acid (5 g/L) gave highest values of pod diameter and pod weight, followed by those received fulvic (1.5 g/L) and humic acid (3 g/L). But the lowest values were recorded with the control i.e. without adding fulvic or humic acids. These results were true in both growing seasons.

Generally, the results of this study clearly showed that although the Balidy cultivar gave the highest vegetative growth i.e. plant highest, number of leaves, fresh & dry weight of leaves and whole plant, Poorvi hybrid recorded the highest number of branches and fresh and dry weight of branches which result in highest early and total pod yield. The superiority of Poorvi hybrid in number of branches my explain the highest early and total pod yield. These results may be due to the role of genotypes and environmental conditions which result variation in their growth, yield and quality (Dash and Misra 1995).

The promotion of plant growth and yield of okra treated with fulvic and humic acid may be refer to it's their own characteristics, were Fulvic acid is low molecular weight and is biologically very active. Because of its low molecular weight, it has the necessity and ability to readily bond minerals and elements into its molecular structure causing them to dissolve and become mobilized Fulvic complexes. Also, Humic acid is rich in carboxyl, hydroxyl, and carbonyl groups as well as in phenols, quinones and semi-quinones (Bravo, 1998 and Yoshino, 1998). The stimulatory effects of humic substances have been directly correlated with increasing of some micronutrients uptake such as Fe, Zn and Mn (Chen and Aviad 1990).

Our results clearly showed that okra plants received the combinations of Fulvic acid (3 g/L) and Humic acid (5 g/L) gave highest values of vegetative growth as well as pod yield and its quality followed by those received fulvic (1.5 g/L) and humic acid (3 g/L). But the lowest values were recorded with the control.

This result may be due to the role of fulvic or humic acids which are harmony with those reported by many investigators. Humic acid application to soils boost up biological processes in soil and hold the nutrients in easily exchangeable form to minimize their leaching from soil profile with peculating water (Brady and Weil 2008). Addition of humic acid increases the uptake of both micro and macro nutrients and led to hormonal activities and improving nutritional status, it shows anti-stress affect in plant body when soil pH and temperature are unfavorable for plant growth (Kulikova *et al.,* 2005).

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).

Table 9: Effect of the interaction treatments between variety and humic and fulvic acid on pods yield and its quality:

Interaction treatments		Yield (ton/fed.)		Pod quality			
Variety	Organic fertilizers	Early yield	Total yield	Length (cm)	Diameter (cm)	Weight (g)	Protein content
				First season			
	Control	0.618	4.116	3.37	2.27	2.18	2.44
	Fulvic 1.5	0.628	5.166	3.60	2.23	2.95	2.59
	Fulvic 3	0.647	6.046	3.63	2.38	3.87	2.68
Balidy	Humic 3	0.664	6.285	3.67	2.47	4.16	2.73
	Humic 5	0.684	6.637	3.77	2.53	5.38	2.86
	Fulvic 1.5 + Humic 3	0.695	6.635	4.60	2.75	7.87	2.66
	Fulvic 3 + Humic 5	0.715	6.773	5.67	2.97	8.47	3.76
	Control	0.861	5.071	4.10	1.07	1.88	3.63
	Fulvic 1.5	0.935	5.486	4.17	1.25	2.10	3.90
	Fulvic 3	0.947	5.787	4.23	1.32	2.97	4.43
Poorvi	Humic 3	0.974	5.884	4.28	1.53	3.02	4.32
	Humic 5	0.971	6.347	4.75	1.68	3.83	4.73
	Fulvic 1.5 + Humic 3	0.984	7.320	5.08	1.82	4.08	4.89
	Fulvic 3 + Humic 5	0.992	8.550	6.27	1.90	4.43	5.53
L.S.D. 0.05		0.015	0.570	N.S.	N.S.	0.57	0.23
				Second season			
	Control	0.626	4.281	3.44	2.19	2.21	2.51
	Fulvic 1.5	0.653	5.406	3.71	2.26	3.05	2.70
	Fulvic 3	0.673	6.255	3.78	2.41	3.91	2.77
Balidy	Humic 3	0.688	6.536	3.78	2.52	4.27	2.81
	Humic 5	0.711	6.935	3.88	2.56	5.44	2.98
	Fulvic 1.5 + Humic 3	0.726	6.900	4.75	2.78	8.02	2.78
	Fulvic 3 + Humic 5	0.747	7.077	5.82	3.00	8.55	3.88
	Control	0.866	5.375	4.25	1.09	2.01	3.81
	Fulvic 1.5	0.956	5.815	4.28	1.28	2.21	4.17
	Fulvic 3	1.010	6.167	4.32	1.34	3.03	4.66
Poorvi	Humic 3	1.026	6.241	4.37	1.56	3.08	4.53
	Humic 5	1.063	6.727	4.88	1.75	3.94	5.03
	Fulvic 1.5 + Humic 3	1.040	7.773	5.19	1.85	4.17	5.17
	Fulvic 3 + Humic 5	1.085	9.096	6.36	1.97	4.59	5.81
L.S.D. 0.05		0.040	0.637	N.S.	N.S.	0.54	0.27

Conclusion

The study demonstrated that, most of investigated growth and yield parameters of okra were increased by application of Fulvic and Humic acid or their combination compared to the control and okra plants is very responsive to the organic fertilizer represented as Fulvic and Humic aced. Further studies on the effect of different rates of Fulvic and Humic acid and or combination between them should be done in the future under micro climate condition of different Bedouin Wadi in South Sinai settlements.

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