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Early yield production of watermelon grown in Wadi El-Tor, South Sinai in solar powered farm

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Abstract

Two year field experiments were conducted at a privet farm, Wadi El-Tor, South Sinai governorate, Egypt during two successive seasons of 2017 and 2018. The experiments included two-watermelon hybrids (Giza1 and Aswan) and two organic fertilizer sources included fulvic acid and humic acid. Organic fertilizers were added at a rate of three levels of 1.5, 3 and 6g/L^1 of irrigation water. Total yield and fruit quality i.e. average fruit weight, cortex thickness, firmness, TSS, dry matter and sweetness of watermelon were recorded. Results indicated that increasing level of organic fertilizers increased the yield of watermelon and enhanced fruit quality. The highest yield of watermelon was recorded when humic acid was applied at level of 6g/l^{-1} followed by fulvic acid at the same rate and the lowest yield was recorded with control treatment.

Keywords: watermelon, solar powered, chemical composition, yield and it's component

1. Introduction

The main idea of this work is to combining recent agricultural skills with cutting edge technology of solar photovoltaic (PV), and some new agriculture practices, will help the remote area farmers to be able to produces energy, access to underground water and produces their food and hence contribute positively in the economy of Bedouin settlement.

A model of 3 Kw solar photovoltaic water pumping was installed in a Bedouin family farm in Wadi El-Tour, south Sinai to pump the irrigation water from a basin (with volume of 50m3 water) to drip irrigation system installed to cultivate 4200m2 feddan (0.42 hectares). This basin was built to temporary host underground water of well 40m depth powered by 5Kw solar photovoltaic water pumping system. This system was previously installed by the National Research Center (NRC) as a part of its contribution in the Egyptian government's strategy to move from pastoral to sedentary farming systems to realize sustainable development of desert communities

Watermelon is a native crop of Egypt, seeds of this plant was recovered from the tomb of Tutankhamen (1333-1323 BC) as reported by Reeves (1990). Watermelon has excellent potential as a fresh crop for local markets. According to production world records of FAO, Egypt ranks 9th in watermelon after China, Turkey, Iran, Brazil, Uzbekistan, Algeria, USA, and Russian. As well as, 2017 data, annual watermelon production of Egypt was 1680994 tons (FAOSTAT, 2017).

Organic matter is important to soil structure, and, therefore, to the health of the crop Doran *et al.* (1996). Organic matter has some advantages in the soil include improving physical conditions of the soil, source of food for microorganisms which help to release nutrients, helps the soil to hold minerals and reduces leaching, bacteria growing on organic matter release complex carbohydrates, which help heavy soil particles into aggregates, acids released in the decomposition process help to release

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nutrients used in plant growth, enhance root penetration, improve water holding capacity of sandy soil and improve drainage in heavy soil (Kirlew & Bouldin, 1987; Sakar & Jonces,1992; Pritam *et al.* 1990 and Piccolo *et. al.* 1996).

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.

Common organic-mineral fertilizers used in plant fertilization are humic substances, which contain humic acid (Manas *et al.,* 2014).

The role of humic acid in stimulating the growth and yield of plants has been attributed to both direct and indirect effects. It has been demonstrated that humic acid can directly affect plant growth by inducing an increase in the absorptive surface area of roots via an ordered remodeling of the root morphology (Schmidt *et al.* 2007). Indirectly, humic acid can improve both yield and quality characteristics of crops by enhancing soil enzyme activity and promoting the growth and activity of microorganisms in the rhizosphere. Increased microbial numbers following humic acid application is primarily due to the role of humic acid in creating soil conditions that favor microbial replication (Sellamuthu and Govindaswamy 2003). The studies were conducted with different humic acid concentrations on plants showed a bell-shape curve of dose response. The optimum concentration was dependent on the specific plant and mode of application (foliar spray or direct soil drench). An increase in nutrient use efficiency was found to be them a jorbio stimulant effect associated with the promotion of vegetable crop growth by humic acid (Boyhan *et al.,* 2001; Neri *et al.,* 2002; Selim and Mosa, 2012; Naidu *et al.,* 2013; Denre *et al.,*2014).

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 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).

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.

Aiken *et al.* (1985) reported that the applying fulvic acid to plants enhanced transport of minerals, improved protein synthesis, plant hormone like activity, promoted photosynthesis, modified enzyme activities. Lotfi *et al*. (2015) on *Brassica napus* found that the physiological responses of fulvic acid application under water stress improved the maximum quantum efficiency of photosystem II and performance index (PI) of plants under both well-watered and limited water conditions.

Malan, (2015) mentioned that humic and fulvic acids as plant biostimulants are mainly produced by biodegradation of lignin containing plant organic matter. Fulvic acids that are always in solution, especially at the pH of productive agricultural soils, also contribute towards cation exchange capacity of the soil (Yamauchi *et al.,* 1984; Malan, 2015).

The present study was carried out to examine the effect of humic acid and fulvic acid in enhancing the growth and yield of two hybrid of watermelon.

2. Materials and Methods

The experiments were carried out during two successive seasons 2017 and 2018 at a privet farm, Wadi El-Tor, South Sinai governorate. Watermelon Seeds (*Citrullus lantus* L.) of each hydride (Giza1 and Aswan) were sowing in the sowing rows closed to drippers on the and 3rd week of November, the distance between the plants was 50cm and 200cm between the rows. Organic fertilizer sources were (humic acid and fulvic acid) and each source was added at three rates of 1.5, 3 and 6 g/L of irrigation water ones a week.

Cultural operations other than the experimental treatments were carried out according to the recommendations of Ministry of Agriculture, Egypt. The drip irrigation system was used. The amount of water applied was calculated by class A pan evaporation method, where reference crop evapotranspiration (Et0) can be obtained from the following formula:

Eto = Kp. Epan mm/day (Dorenbos and Hassam 1979)

The experiments were arranged in split design, two treatments (Giza F1 and Aswan F1 hybrid) and, three sub treatments (levels of fulvic and humic acid in addition to control), and data of the experiment were subjected to statistical analysis of variance (Snedicor and Cochran,1980)

2.1. Data recorded:

2.1.1. Fruit yield and its components:

a) Early yield:

The fruit yield of each plot was obtained from the first and second pickings, which considered as early yield and calculated as ton/fed.

b) Total yield:

The total fruit yield of each plot obtained from all pickings all over the season was determined and then calculated as ton/fed.

c) Marketable yield:

Fruits free of disorders and available for local markets were considered as the marketable yield and calculated as ton/fed.

d) Unmarketable yield:

The disordered fruits, wilted, cracked and other injurious fruits were discarded and weighted for all pickings all over the season and then calculated as ton/fed.

e) Fruit quality

A random sample of 3 fruits from each experimental plot were taken at one time for all experimental plots (2^{nd} picking) and the following data were obtained:

Concerning on the quality of watermelon this data were recorded, average fruit length (cm), average fruit diameter (cm), average fruit weight (Kg/fruit), cortex thickenss (cm), firmness using pressure tester (10LB fruit tester), TSS percentage, dry matter, Sweetness as score was determined using scale ranging from 1 (low sweetness) to 5 (highest sweetness).

2.2. Chemical constituents

The leaves were washed in tap water containing a small amount of detergent. After excess water was allowed to drain away, they were placed in paper towels to remove additional moisture and oven dried at 70C. The dry samples of leaves were grounded and then 0.2 g of each was digested in a mixture of sulphuric and percloric acids and then used for N, P and K determinations. Total nitrogen was determined as % using microkjeldahl apparatus as described by Black (1965). Phosphourus (ug/g) was determined choloremeterically as reported by Troug and Meyer (1939). Potassium (mg/g) was determined Flame photometricaly as reported by Brown and Lilleland (1946).

3. Results and Discussion

3.1. Effect of hybrids and fulvic & humic acid levels and their interaction on early, total and marketable yield:

3.1.1. Effect of Hybrids (Giza F1 and Aswan F1) on the early, total and marketable yield

The effect of different hybrid on the yield of watermelon was recorded in Table (1). Although Aswan hybrid recorded the highest early yield of watermelon, it recorded at same time the lowest total yield. Marketable yield data showed that Aswan F1 hybrid had the higher value in comparison with Giza F1 hybrid.

3.1.2. Effect of fulvic and humic acid on the early, total and marketable yield

Watermelon yield was increased with increasing the level of fulvic and humic acid (Table 1). Increasing both fulvic and humic acid level led to an increase in the early, total and marketable yield. This increase might be attributed to the increase in the growth of plant, which was obtained as a result of increasing organic material in the soil. In addition, it could be referred to the favorable effect of organic substance on the N, P and K content of leaves. Total yield is the function of the vegetative growth, mineral content and dry matter accumulation in plant tissues (Abou-El-Magd 1979). So that, the higher total yield of watermelon fruits obtained by fulvic and humic acid may be the result of the increase in plant growth, nutrient uptake and dry matter accumulation form increasing organic substance.

Table 1: Effect of watermelon cultivars, organic treatments and their interaction on early yield as (ton/fed.), total yield (ton/fed.) and Marketable yield (ton/fed.) of watermelon leave during 2017-2018.

Treatments		Early yield (ton/fed.) 1st season	Early yield (ton/fed.) 2nd season	Total yield (ton/fed.) 1st season	Total yield (ton/fed.) 2nd season	Marketable yield (ton/fed.) 1st season	Marketable yield (ton/fed.) 2nd season
The effect of the cultivars							
Giza1		13.06 B	10.92 B	23.22 A	19.74 A	14.57 B	12.43 B
Aswan		14.13 A	11.98 A	21.98 B	18.68 B	17.37 A	14.75 A
The effect of the organic mater (Fulvic and Humic)							
	Control	11.83 E	10.17 D	19.06 F	16.15 E	13.2 F	11.2 F
	Fulvic 1.5g/L	12.42 D	10.55 D	20.01 E	17.05 D	13.8 F	11.7 F
	Fulvic3g/L	13.11 C	11.03 CD	21.18 D	17.99 D	14.6 E	12.4 E
	Fulvic 6g/L	13.60 C	11.59 B	22.93 C	19.47 C	15.8 D	13.4 D
	Humic 1.5 g/L	14.28 B	12.14 A	24.08 B	20.41 B	16.6 C	14.1 C
	Humic 3 g/L	14.72 B	11.74 B	25.33 A	21.55 A	19.7 A	16.9 A
	Humic 6 g/L	15.21 A	12.90 A	25.61 A	21.81 A	17.74 B	15.1 B
The effect of the interaction							
Giza1	**Control**	11.42 f	9.94 f	19.62 g	16.65 f	11.7 h	10.0 g
	Fulvic 1.5g/L	11.99 e	10.21 d	20.59 f	17.54 e	12.3 g	10.5 g
	Fulvic 3g/L	12.70 d	10.80 d	21.80 f	18.53 e	13.0 f	11.1 f
	Fulvic 6g/L	13.13 c	11.20 c	23.60 d	20.02 c	14.1 e	11.9 f
	Humic 1.5g/L	13.78 c	11.69 c	24.78 c	21.11 b	14.8 de	12.6 e
	Humic 3g/L	13.80 c	10.21 d	25.91 b	22.00 a	20.0 a	17.3 a
	Humic 6g/L	14.61 b	12.39 b	26.23 a	22.30 a	15.7 d	13.3 de
Aswan	**Control**	12.24 d	10.41 d	18.50 h	15.66 g	14.6 de	12.3 e
	Fulvic 1.5g/L	12.85 d	10.90 d	19.42 g	16.55 f	15.3 d	13.0 de
	Fulvic3g/L	13.52 c	11.27 c	20.55 f	17.44 e	16.2 c	13.7 de
	Fulvic 6g/L	14.07 b	11.99 c	22.26 e	18.93 e	17.5 c	14.9 d
	Humic 1.5 g/L	14.78 b	12.59 b	23.38 d	19.72 d	18.4 bc	15.5 c
	Humic 3 g/L	15.65 a	13.28 a	24.74 c	21.11 b	19.5 b	16.6 ab
	Humic 6 g/L	15.81 a	13.41 a	24.99 c	21.32 b	19.7 b	16.8 ab

3.1.3. Effect of interaction between organic fertilizers (fulvic and humic acid) and hybrids (Giza F1 and Aswan F1) on the early, total and marketable yield

The highest early yield of watermelon was recorded by treatments, which received the humic acid at the high level with Giza hybrid, while Aswan F1 plants received the highest level of humic acid recorded the highest early and marketable fruit yield of watermelon (Table 1).

3.2. Effect of hybrids and fulvic & humic acid levels and their interaction on fruit quality of watermelon:

3.2.1. Effect of cultivars (Giza F1 and Aswan F1) on fruit quality

Table (2) shows that the effect hybrids on fruit quality expressed as fruit length, diameter, weight, cortex thickness, TSS and dry matter was statistically. Results showed that Giza F1 hybrid had the highest value of fruit quality characters in comparison with Aswan F1 except in Firmness and TSS where Aswan F1 value had the value.

3.2.2. Effect of fulvic and humic acid on fruit quality

Data in Table (2) show that plants treated with 6g/L fulvic acid recorded the highest fruit length in comparison with other fertilizer treatments while, plants had 6g/L of humic acid recorded the highest fruit diameter. In the meantime, the un-treated plants (control) recorded the lowest fruit diameter and length.

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Table 2: Effect of watermelon cultivars, organic treatments and their interaction on fruit quality of watermelon during 2017-2018.

Treatments		Average fruit length (cm)		Average fruit diameter (cm)		Average fruit weight (Kg/fruit)		Cortex thickness (cm)	
		1st season	2nd season	1st season	2nd season	1st season	2nd season	1st season	2nd season
The effect of the cultivars									
Giza1		24.4 A	17.8 B	22.5A	16.5 B	4.7A	3.8 B	1.20 A	1.11A
Aswan		21.4 B	18.8A	22.0A	17.5A	4.4 B	4.0 A	1.00 B	0.93 B
The effect of the organic matter (Fulvic and Humic)									
Control		20.8 D	17.4 C	20.3 F	16.4 C	4.2B	3.6 D	1.02D	0.90 D
Fulvic 1.5g/L		21.8 C	17.8 C	21.3 E	16.7 C	4.4AB	3.6 D	1.07 C	0.99 D
Fulvic3g/L		22.0 C	17.8 C	21.5 E	16.5 C	4.4AB	3.7 D	1.07 C	1.00 C
Fulvic 6g/L		24.5 A	18.4 B	22.9D	17.1 B	4.6 A	4.2 B	1.16A	1.08 A
Humic 1.5 g/L		23.1 B	18.3 B	22.6C	17.0 B	4.6 A	3.9 C	1.13 B	1.05 B
Humic 3 g/L		23.9 B	18.4 B	23.3B	17.4 B	4.8 A	4.1 A	1.16A	1.08 A
Humic 6 g/L		24.2 A	19.5A	24.0A	18.0A	4.7 A	4.2 A	1.10 B	1.05 B
The effect of the interaction									
Giza1	**Control**	22.3 d	16.8 d	20.51 f	15.2 d	4.3 bc	3.5 b	1.12 d	0.99 d
	Fulvic 1.5g/L	23.4 d	17.2 c	21.5 d	16.0 c	4.5 b	3.4 b	1.18 c	1.08 bc
	Fulvic 3g/L	23.6 d	17.3 c	21.7 d	16.2 c	4.5 b	3.6 b	1.18 c	1.11 bc
	Fulvic 6g/L	24.7 c	17.6 c	22.7 c	16.2 c	4.8 b	4.1 a	1.25 b	1.15 b
	Humic 1.5 g/L	24.8 c	17.6 c	22.8 d	16.4 c	4.8 b	3.8 b	1.24 b	1.14 b
	Humic 3 g/L	26.2 a	18.1 b	24.1 a	17.8 b	5.0 a	4.0 a	1.31 a	1.21 a
	Humic 6 g/L	25.6 b	19.7 a	24.3 a	17.8 b	4.7 b	4.2 a	1.13 c	1.10 bc
Aswan	**Control**	19.3 g	18.1 b	20.1 f	17.6 b	4.1 c	3.6 b	0.91 f	0.81
	Fulvic 1.5g/L	20.3 f	18.5 b	21.1 e	17.3 b	4.3 bc	3.8 b	0.96 e	0.89 e
	Fulvic 3g/L	20.5 f	18.4 b	21.3 e	16.8 c	4.3 bc	3.8 b	0.96 e	0.89 e
	Fulvic 6g/L	24.3 c	19.2 a	23.1 b	18.0 a	4.5 b	4.2 a	1.07 d	1.00 c
	Humic 1.5 g/L	21.5 e	19.0 a	22.4 c	17.7 b	4.5 b	4.0 a	1.02 f	0.95 d
	Humic 3 g/L	21.5 e	18.8 b	22.4 c	17.1 b	4.5 b	4.1 a	1.01 f	0.94 d
	Humic 6 g/L	22.7 d	19.4 a	23.7 b	18.3 a	4.8 b	4.1 a	1.07 d	1.00 c

Values followed by the same letter (s) are not significantly different at 5%.

Table 2: Continued:

Treatments		Firmness using pressure tester (10LB fruit tester)		TSS		Dry matter	
		1st season	2nd season	1st season	2nd season	1st season	2nd season
Giza1		13.3 B	12.3 B	13.3 B	12.3 B	1.20 A	1.11 A
Aswan		13.8 A	12.6 A	13.8 A	12.6A	1.00 B	0.93 B
The effect of the organic matter (Fulvic and Humic)							
Control		12.8 C	11.9 C	12.8 C	11.9 C	1.02 E	0.90 E
Fulvic 1.5g/L		13.3 B	12.3 B	13.3 B	12.3 B	1.07D	0.99 DE
Fulvic 3g/L		13.3 B	12.0 B	13.3 B	12.0 B	1.07D	1.00 C
Fulvic 6g/L		13.1 B	11.9 C	13.1 B	11.96C	1.16A	1.08 A
Humic 1.5 g/L		14.0A	13.0A	14.0 A	13.0A	1.13 B	1.05 B
Humic 3 g/L		14.3A	13.2A	14.3 A	13.2A	1.16A	1.08 A
Humic 6 g/L		14.0A	12.9 B	14.0 A	12.93B	1.10 C	1.05 B
The effect of the interaction							
Giza1	**Control**	12.6 d	12.0 b	12.6 d	12.0 b	1.12 d	0.99 f
	Fulvic 1.5g/L	13.1 c	11.7 c	13.1 c	11.7 c	1.18 c	1.08 d
	Fulvic 3g/L	12.9 d	11.6 c	12.9 d	11.6 c	1.18 c	1.11 c
	Fulvic 6g/L	13.8 c	12.5 b	13.8 c	12.5 b	1.25 b	1.15 b
	Humic 1.5 g/L	13.6 c	12.9 b	13.6 c	12.9 b	1.24 b	1.14 b
	Humic 3 g/L	14.4 b	13.4 a	14.4 b	13.4 a	1.31 a	1.21 a
	Humic 6 g/L	12.9 d	11.9 c	12.9 d	11.9 c	1.13 d	1.10 c
Aswan	**Control**	13.02	11.9 c	13.0 c	11.9 c	0.91 f	0.81 g
	Fulvic 1.5g/L	13.6 c	12.8 b	13.6 c	12.8 b	0.96 e	0.89 f
	Fulvic 3g/L	13.6 c	12.3 b	13.6 c	12.3 b	0.96 e	0.89 f
	Fulvic 6g/L	12.3 d	11.3 c	12.3 d	11.3 c	1.07 e	1.00 e
	Humic 1.5 g/L	14.4 b	13.1 a	14.4 b	13.1 a	1.02 f	0.95
	Humic 3 g/L	14.3 b	13.0 a	14.3 b	13.0 a	1.01 f	0.94 f
	Humic 6 g/L	15.1 a	13.8 a	15.1 a	13.8 a	1.07 e	1.00 e

Values followed by the same letter (s) are not significantly different at 5%.

The highest fruit weight was recorded with plants received humic acid at the rate of 3g/L (4.67kg/fruit) flowed by the plats received humic acid at the rate of 6g/L (4.64 Kg/fruit) and the lowest fruit weight was recorded by control plants (4.1 Kg/fruit).

Plants received fulvic and humic acid at the rate of 3g/L recorded the thicker fruit cortex while the lowest cortex thickness was recorded by control plants. Regarding fruit firmeness, the plants received humic acid at different levels had the higher fruit firmenss in comparison with all plants received fluvic acid.

Fruit of plants received humic acid at the rate of 3g/L recorded the highest TSS and value followed by fruit of plants received humic acid at the rate of 6 and 1.5 g/L, while the lowest value of TSS was recorded with fruit of control plants. Obtained data showed that fruit of plant received humic and fulvic acid at the rate 6g/L gives the highest dry matter content.

3.2.3. Effect of inter action between organic fertilizers (fulvic and humic bacid) and hybrids (Giza F1 and Aswan F1) on fruit quality

In general, fruit quality of watermelon enhanced with all used hybrids when both fulvic and humic acid were used (Table 2).

The highest fruit length and diameter were recorded by Giza F1 hybrid receiving the high level of humic acid (3 and 6 g/L). Lower marketable fruit weight resulted by Aswan F1 hybrid doesn't received any organic fertilizers.

Average fruit cortex, Firmness and TSS increased with increasing the level of applied fulvic and humic acid in all used hybrids. The highest fruit TSS was recorded with Aswan hybrid when humic acid was used at the highest level.

3.3. Effect of hybrids and fulvic & humic acid levels on NPK content of watermelon leaves:
Effect of fulvic and humic acid on NPK content

Data tabulated in table (3) reflected the effect of increasing organic rate on mineral content of watermelon leaves. Increasing the rate of fulvic and humic acid resulted in an increase in N, P and K content of watermelon leaves in both seasons of the experiments.

The increases in N, P and K content of leaves due to organic fertilization might be attributed to the release of nutrients from it's components to the soil solution (Eissa *et al.* 1995). This result was in agreement with Bohn and Dewes (1997). They indicated that applying 30 ton composted farmyard manure per/ha. increased nitrate content in potato tubers. He added that increasing rate of add manure resulted in an increases in N and K uptake. These results agreed with Sharma and Singh (1998) which reported that increasing the application rate of different organic fertilizers increased the uptake of N, P, K, Zn and Cu.

3.3.1. Effect of cultivars on NPK content

Analysis of the variance between the different hybrids of watermelon shows highly significant differences in leaves nutrient content at 5% levels (Table 3). The table shows that nitrogen, potassium and phosphorus differ in each variety. The highest nitrogen and potassium concentration was found with Aswan F1 hybrid in both seasons. On the other hand, Giza F1 hybrid recorded the highest level of Phosphorus when compared with Aswan F1 hybrid. Differ in nutrient content between hybrids was demonstrated by Smith (1972) and Epstein, (1972). They reported that plant species and even hybrid of a given species are known to have different nutritional needs.

3.3. Effect of interaction between different studied treatments.

Data presented in table (3) shows the interaction between different treatments on NPK content of watermelon leaves. N, P and K content of leaves increased as a result of combined effect of Hybrids (Giza F1 and Aswan F1) and organic source (fulvic and humic). The highest values of N content of watermelon leaves were recorded by Aswan F1 hybrid which received the 3g/L of fulvic acid. On the other hand lower value of N content of the leaves resulted by un-treated (control) Giza1 hybrid.

The highest values of P content of watermelon leaves were recorded by treatments, which received humic acid at rate of 6g/L/week with Giza F1 hybrid. Lower value of P content of watermelon leaves resulted by the Aswan hybrid control.

The highest values of K content of watermelon leaves were recorded by Aswan F1 hybrid, which received the high level of humic acid. Lower value of K content of watermelon leaves resulted by the combined effect humic acid at the low level with Giza F1 hybrid.

Table 3: Effect of watermelon cultivars, organic treatments and their interaction on NPK content of watermelon leave during 2017-2018.

Treatments		N % 1st season	N % 2nd season	P (µ/g) 1st season	P (µ/g) 2nd season	K mg/g 1st season	K mg/g 2nd season
The effect of the cultivars							
Giza1		2.73 B	2.49 B	3013.61 A	2772.53 A	44.70 B	41.07 B
Aswan		2.97A	2.75 A	1894.36 B	1742.72 B	49.56 A	45.56 A
The effect of the organic treatments							
Control		2.76 D	2.47 E	2294.33 D	2110.67 D	44.98 E	41.41 D
Fulvic 1.5g/L		2.86 C	2.68 B	2408.03 B	2215.58 B	47.66 B	43.69 C
Fulvic 3g/L		2.66 E	2.48 D	2263.05 D	2081.68 E	45.00 D	41.36 D
Fulvic 6g/L		2.94 B	2.68 B	2373.77 C	2183.76 C	48.29 AB	44.34 B
Humic 1.5 g/L		2.80 C	2.58 C	2330.57 C	2144.04 D	46.72 C	43.00 C
Humic 3 g/L		2.95 B	2.73 A	2444.27 B	2248.60 B	49.25 A	45.28 A
Humic 6 g/L		2.99 A	2.73 A	3063.90 A	2819.03 A	47.99 B	44.14 B
The effect of the interaction							
Giza1	**Control**	2.78 c	2.45 cd	2924.4 b	2690.4 b	44.69 d	41.11 d
	Fulvic 1.5g/L	2.85 b	2.58 c	3064.4 ab	2819.6 ab	47.66 c	43.49 c
	Fulvic 3g/L	2.45 e	2.28 e	2778.4 c	2555.9 c	42.45 e	39.02 ef
	Fulvic 6g/L	2.70 c	2.48 cd	2911.5 b	2678.6 b	44.95 d	41.41 d
	Humic 1.5 g/L	2.57 d	2.38 d	2917.4 b	2683.7 b	44.58 d	41.01 e
	Humic 3 g/L	2.79 c	2.58 c	3057.4 ab	2812.6 ab	47.21 c	43.39 c
	Humic 6 g/L	2.95 b	2.68 b	3441.7 a	3166.9 a	41.37 e	38.03 f
Aswan	**Control**	2.73 c	2.48 cd	1664.3 f	1530.9 f	45.28 d	41.71 d
	Fulvic 1.5g/L	2.88 b	2.78 ab	1751.7 ef	1611.5 ef	47.66 c	43.89 c
	Fulvic 3g/L	2.87 b	2.68 b	1747.7 ef	1607.5 ef	47.54 c	43.69 c
	Fulvic 6g/L	3.18 a	2.88 a	1836.1 e	1688.9 e	51.64 b	47.27 b
	Humic 1.5 g/L	3.02 ab	2.78 ab	1743.7 ef	1604.4 ef	48.86 c	44.98 c
	Humic 3 g/L	3.11 a	2.88 a	1831.1 e	1684.6 e	51.30 b	47.17 b
	Humic 6 g/L	3.03 ab	2.78 ab	2686.1 d	2471.2 d	54.62 a	50.25 a

Values followed by the same letter (s) are not significantly different at 5%.

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