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Effect of Different Sources of Organic Manures and Different Levels of Humic and Fulvic Acid on Growth, Flowering, Yield and its Components of Watermelon Plants

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ABSTRACT

This work was carried out of private farm located in Qalabshu, Gamasa District, Dakahlia Governorate, Egypt, during the early summer plantings of 2017 and 2018 to study the effect of different sources of organic manures and different levels of humic and fulvic acid on growth, flowering, yield and its components and sugar in fruit of watermelon plants (*Citrullus lantus* L.) c.v. Romero grafted on Shantosa species. Twenty two treatments were designed in complete randomize block system with three replications, The treatments consisted of (FYM, Compost, Chicken manure and mix between them) in presence of 2 and 4 kg for each humic and fulvic acid comparing to the control. The results obtained shows that there were significant differences among treatments in most parameters during the two seasons. All organic sources increased all parameters and found that the highest significant values of leaf area, dry weight, number of male and female flower as well as average weight of fruits, number of fruits, dry matter, total yield, reducing , non reducing and total sugar of fruits were recorded with application of (FYM + compost + chicken manures) in presence of 4 kg humic and 4 kg fulvic acid.

***Keywords*: FYM, compost, chicken manure, humic, fulvic acid and watermelon.**

INTRODUCTION

Watermelon (*Citrullus lanatus* L.) is one of the main summer fruits importance, and it is widely cultivated over the world. However, particularly under long-term watermelon crops continuous mono-culture, can create major problems, for example, high seedling mortality, low rates of seed germination, yellow leaf, stunted plant growth, blight, morbidity, leading to low quality fruit yield. The primary causes of these issues with consistent watermelon cropping result from changes in the soil, especially inside the crop rhizosphere. Continuous cropping may adjust the microbial soil community and produce soil abnormalities, such as deplete nutrients, dissolve the soil physical properties, and favor the gathering of plant autotoxins (Nie *et al.*, 2007). Additionally, soil deterioration can have a negative feedback impact on the development of the plants (Huang *et al.*, 2013), which undermines the supportable creation of watermelon. Reestablishing soil health is basic to solving the issues related with consistent watermelon cultivation.

Egypt during years (2013, 2014, 2015, 2016, 2017) had planted totally are/ha (46974 , 70170 ,46989 ,56313 , 38700 , 45939) and productions / ton were (1483255 , 2014722 , 1510032 ,1646020 ,1232312 ,1483255) in consecutive order According to Food and agriculture organization (FAO state, 2018), and on 2019 the Egyptian Ministry of Agriculture said in a press report that the total area cultivated with watermelon was 81798 Fadden out of which 19798 was the old land and 6200 Fadden the new land.

In this way, in the recent years, organic fertilization has also been utilized as an economic and environmental alternative, in the fractional or total replacement of chemical fertilizers. Use of organic fertilizer these days has been on the increase drastically particularly in improving soil efficiency and production of crop (Ceglie *et al.*, 2016). Organic fertilizers are earth friendly, working in congruity with nature which are found to have unrivaled nutritional value (San Bautista *et al.*, 2005). The manuring in the tropics is a higher priority than the temperate region, because of exorbitant weathering and leaching. The tropical soil turns seriously impoverished in plant nutrients and proper manuring can just assume an essential part in crop improvement. The utilization of organic matters upgrades soil productivity, improves the content of organic carbon in soil, enhances the activities of microorganisms in the soil, improves soil structure and the status of nutrient in the soil as well as plant yield (Aguyoh, *et al.*, 2011).

At present, the people are willing to get the vegetable without the inorganic fertilizer, due to the suffering people with some serious infections which are because of the effect of inorganic fertilizer (Asaduzzaman *et al.*, 2010). With proceeding consumer concerns related to the environment and the chemicals used in food production, and the developing availability of certified organic production, the viewpoint for continuing growth of organic production is bright (Dimitri and Greene, 2002). Farm income will also improve when farmers use less money on fertilizers and pesticides for growing crops (Masarirambi *et al.*, 2010).

According to these investigation, it decomposes in the soil releasing nutrients for crop uptake. It gives the essential nutrients to the plants and furthermore improve the structure soil and are considered as one of the main important part of sustainable agriculture because of having more content of P and N that plays a crucial structure blocks for plant proteins and thus contributive to plant growth. Its application enlisted over 53% increments of N level in the soil, from 0.09% to 0.14% and exchangeable cations increment with application of manure

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(Boateng *et al.*, 2006). It can be a significant resource for small grain, grass and other crop production. Consequently use of organic manures like compost, FYM and chicken manure to soil not only improve soil physical properties, water holding capacity, pH but also add important nutrients to the soil, thus increase the nutrient availability and absorption. Poultry manure had been reported to improve growth and yield of maize relative to no fertilizer (Adeniyan and Ojeniyi, 2005; Ezeibekwe *et al.,* 2009) and improves the chemical and biological qualities of the soil which increases crop productivity relative to chemical fertilizers (Obi and Ebo, 1995).

Humic substances are created through organic matter deterioration and utilized as soil fertilizers in order to improve soil structure and soil microorganisms (Halime *et al*., 2011). As indicated by previous investigations, humates appear to have a specific good impact on the nutrient supply. Subsequently the use of humates was treated as an approach to improve both the nutrient balance and plant vitality (Boehme *et al.*, 2005). Foliar application of these substances also advance growth, and increases yield and quality in plant species number (Yildirim, 2007; Karakurt *et al.,* 2009) at least partially through increasing nutrient uptake, serving as a source of mineral plant nutrients and regulator of their release (Atiyeh *et al.*, 2002). Moreover, humic substances have been apeared to stimulate shoot and root growth and nutrient uptake of vegetable crops (Akinremi *et al.*, 2000; Cimrin and Yilmaz, 2005). Additionally, humates impact the respiration-process, amino acids and nitrate accumulated, the amount of sugars and make the plants resistant against diseases and viruses (Boehme *et al*., 2005).

Keeping in view the importance of organic manure a study was planned to evaluate the influence of organic manures in enhancing the growth and yield of watermelon cultivars with application of humic substance as humic and fulvic acid.

MATERIALS AND METHODS

This work was carried out of private farm located in Qalabshu (31°43´40.97"N, 31°32´91.69"E), Gamasa District, Dakahlia Governorate, Egypt, during the early summer planting seasons of 2017 and 2018 to study the effect of different organic manures and different levels of humic and fulvic acid on growth, flowering, yield and its components and sugar in fruit of watermelon plants (*Citrullus lantus* L.) c.v. Romero grafted on Shantosa species.

Before soil preparation, samples from the experimental soil were randomly taken (0-30 cm) depth from the soil surface to determine some physical and chemical properties (Table 1). Also, the analysis water irrigation was shown in Table 2.

Table 1. Physical and chemical properties of the experimental soil during the two growing seasons (2017 and 2018)

Soil characters		2017 season	2018 season
Particle size distribution (%)	Coarse sand	3.76	3.58
	Fine sand	24.39	23.96
	Silt	38.15	38.89
	Clay	33.70	33.57
	Texture class	Silt clay loam	
EC dS m^{-1}(1:5)		1.13	1.09
pH (1:2.5)*		7.87	7.75
S.P %		54.5	52.6
Organic matter g kg^{-1}		1.07	0.96
T. $CaCO_3$ g kg^{-1}		4.09	3.96
Available nutrients (mg kg^{-1})	N	48.9	47.1
	P	4.95	4.78
	K	188.5	185.2

Table 2. Physical and chemical properties of the irrigation water during the two growing seasons (2017 and 2018)

Samples	pH	EC ds.m^{-1}	Ions meq/L							
			Ca^{++}	Mg^{++}	$Na^{=}$	K^{+}	$CO^{=}$	$HCO3^{-}$	Cl^{-}	SO_4
water	7.78	3.06	6.12	4.59	19.26	0.63	-	7.23	17.44	5.93

The grafted transplanting of Romero variety was transplanted in the open field on 17th March in the first season and 15th March in the second season.

Manure quantities which have been used per faddan: Farmyard manure 10 m^3/fed.**,** compost 7 m^3/fed. and chicken manure 10 m^3/fed.

The design used was a complete randomize block system with three replicates, each of the 22 treatments was randomized with each replicate. The experimental plot contained one ridge of 20 meters long and 4 meters wide. Thus making an area of 80 m^2.

Twenty two treatments were included as the following in Table (3):

The grafted transplanting of Romero was transplanting when the soil humidity was suitable in hills with 150 cm distance each plot contents 13 plant.

Cultural practices such weeding, supplementary irrigation, spraying against anthraconose, fusarium wilt and insect pasts were done whenever it was needed.

Organic fertilization, humic acid and flvic acid at the rate of etch plot were added to the soil before sowing as follows in Table (4):

Recommended for mineral fertilization doses by the Ministry of Agric. and Soil Recl. (MASR) for watermelon plants production was used as follows: Nitrogen fertilizer at the rate of 1 Kg N was applied using ammonium sulphate (20.5 % N). Phosphor fertilizer at the rate of 2.58 Kg P_2O_5 was applied as super phosphate (15 % P_2O_5). Potassium fertilizer at the rate of 720 gm K_2O was applied in potassium sulphate (48 % K_2O) and 500 gm magnesium sulphate as well as 800 gm sulpher. All mineral fertilization was mixed with organic manure.

Table 3. Treatments of each trial (experiment) during two seasons:

NO.	Treatments
1	Control
2	Farmyard manure
3	Farmyard manure+ 2 kg Humic acid + 2 kg fulvic acid
4	Farmyard manure+ 4 kg Humic acid + 4 kg fulvic acid
5	Compost
6	Compost + 2 kg Humic acid + 2 kg fulvic acid
7	Compost + 4 kg Humic acid + 4 kg fulvic acid
8	Chicken manure
9	Chicken manure+ 2 kg Humic acid + 2 kg fulvic acid
10	Chicken manure+ 4 kg Humic acid + 4 kg fulvic acid
11	Farmyard manure+ compost
12	Farmyard manure+ compost +2 kg Humic acid + 2 kg fulvic acid
13	Farmyard manure+ compost + 4 kg Humic acid + 4 kg fulvic acid
14	Farmyard manure + Chicken manure
15	Farmyard manure + Chicken manure+ 2 kg Humic acid + 2 kg fulvic acid
16	Farmyard manure + Chicken manure+ 4 kg Humic acid + 4 kg fulvic acid
17	Chicken manure + compost
18	Chicken manure + compost + 2 kg Humic acid + 2 kg fulvic acid
19	Chicken manure + compost + 4 kg Humic acid + 4 kg fulvic acid
20	Farmyard manure+ Chicken manure + compost
21	Farmyard manure + chicken manure + compost + 2 kg Humic acid + 2 kg fulvic acid
22	Farmyard manure + chicken manure + compost + 4 kg Humic acid + 4 kg fulvic acid

Table 4. The levels of organic fertilization, humic and fulvic as for each plots:

NO.	Treatments
1	Control
2	0.2 m^3 FYM
3	0.2 m^3 FYM + 40 gm Humic acid + 40 gm fulvic acid
4	0.2 m^3 FYM + 80 gm Humic acid + 80 gm fulvic acid
5	0.14 m^3 Compost
6	0.14 m^3 Compost + 40 gm Humic acid + 40 gm fulvic acid
7	0.14 m^3 Compost + 80 gm Humic acid + 80 gm fulvic acid
8	0.2 m^3 CK
9	0.2 m^3 CK + 40 gm Humic acid + 40 gm fulvic acid
10	0.2 m^3 CK + 80 gm Humic acid + 80 gm fulvic acid
11	0.2 m^3 FYM + 0.14 m^3 compost
12	0.2 m^3 FYM + 0.14 m^3 compost + 40 gm Humic acid + 40 gm fulvic acid
13	0.2 m^3 FYM + 0.14 m^3 compost + 80 gm Humic acid + 80 gm fulvic acid
14	0.2 m^3 FYM + 0.2 m^3 CK
15	0.2 m^3 FYM + 0.2 m^3 CK + 40 gm Humic acid + 40 gm fulvic acid
16	0.2 m^3 FYM + 0.2 m^3 CK + 80 gm Humic acid + 80 gm fulvic acid
17	0.2 m^3 CK + 0.14 m^3 compost
18	0.2 m^3 CK + 0.14 m^3 compost + 40 gm Humic acid + 40 gm fulvic acid
19	0.2 m^3 CK + 0.14 m^3 compost + 80 gm Humic acid + 80 gm fulvic acid
20	0.2 m^3 FYM +0.2 m^3 CK + 0.14 m^3 compost
21	0.2 m^3 FYM + 0.2 m^3 CK + 0.14 m^3 compost + 40 gm Humic + 40 gm fulvic acid
22	0.2 m^3 FYM + 0.2 m^3 CK + 0.14 m^3 compost + 80 gm Humic + 80 gm fulvic acid

***FYM = farmyard manure CK = chicken manure**

Manure for each plot and irrigated up to saturation percentages. The plots were left for two weeks to elucidate the damage on seedlings and their roots resulted from the heat of decomposition.

Chemical analysis of the organic manures used are presented in Table (5)

Table 5. Chemical analysis of the organic manures used

Organic manure properties	FYM		Compost		Chicken manure	
	1st	2nd	1st	2nd	1st	2nd
pH 1:5	6.57	6.63	6.21	6.33	6.03	6.16
EC (1:10)(dSm^{-1})	4.16	4.25	3.92	4.07	3.75	3.83
Organic matter (%)	66.41	66.54	68.93	69.11	77.06	77.15
Organic carbon (%)	38.61	39.01	40.08	40.34	44.80	44.96
Total nitrogen (%)	1.95	2.09	2.33	2.45	3.09	2.97
C/N ratio	19.8	18.67	17.2	16.46	14.5	15.13
Total Phosphorus (%)	0.31	0.39	0.37	0.43	0.73	0.78
Total Potassium (%)	0.51	0.58	0.59	0.67	0.68	0.77
SP%	176	183	1930	1943	135	143

Data recorded:

A. Vegetative growth characters:

- Growth characters were recorded at 35, 70 and 105 days after transplanting. Five samples of plants were randomly chosen from each experimental unit to determine the following characters: Leaf area cm^2 and plant dry weight %.

B. Flowering characters:

Five plants in each plot were labolled and the total numbers of staminate and pistillate flowers were counted at 3 day intervals of growth and the following data were recorded: number of male and female flower and Sex ratio%.

C. Fruit yield

The fruits were harvested when the fruits were rapining and the following data were recorded: Number of fruit per plant, average fruit weight (kg), dry matter fruit % and total yield ton/fed.

D. Chemical composition of fruit:-

The oven dried materials of fruits were ground and stored for determined the chemical compounds. Total soluble sugar, was determined according to the method described by Sadasivam and Manickam, (1996). Reducing sugar was estimated by Nelson-Somogy method as described by Naguib (1964*)*.

Data were statically analyzed according to the technique of analysis variance (ANOVA) and the least significant difference (L.S.D.) and Duncan's method were used to compare the deference between the means of treatments values to the methods described by Gomez and Gomez, (1984). All statistical analyses performed using analysis of variance technique by means of CoSTATE Computer Software.

RESULTS AND DISCUSSION

1. Vegetative growth parameters:

Leaf area cm^2:

In regard to the effect of different sources of organic manures and humic substances on leaf area (cm^2) after 3 stages of 35, 70 and 105 days during 2017 and 2018, data at Table 6 illustrated that application of different sources from organic manures in individual way or mixed together increased leaf area (cm^2) comparing with the untreated plants, the highest values of leaf area (cm^2) realized with the application of FYM + compost + CK comparing with other treatments of organic manures.

In regard to the effect of humic substances (humic and fulvic acids) on leaf area cm^2 at the same Table. Data indicated that all treatments of organic manures mixed with humic acid at any rats increased significantly the leaf area (cm^2) compared with all treatments and the highest values of leaf area cm^2 was realized with FYM + compost + CK mixed with 4 kg from both of humic and fulvic acids as 2613.67, 3013.33, and 3925.67 in 2017 and 2631.67, 3077.33, and 3986.67 cm^2 in 2018 for 35, 70 and 105 days, respectively.

Dry weight/plant (g):

Dry weight/plant (g) affected by the application of different sources from organic manure (FYM, compost and chicken manure or mixed) and some humic substance (humic and fulvic acids) after 3 stages 35, 70 and 105 days during 2017 and 2018 are presented in Table 7.

It could be observed that the application of organic manures, i.e. FYM, compost and chicken manure in individual way or mixed together, the dry weight g/plant gained increasing compared with the untreated plants. On the other hand, within the different organic manures the best dry weight/plant (g) was obtained by watermelon plants receiving FYM + compost + CK followed in descending order by that supplied with chicken manure + compost then chicken manure + FYM comparing with other organic treatments. The statistical analysis of the obtained data revealed that the difference within different organic treatments were great enough to be significant at 5% level.

Regarding the effect of humic substances, data at Table 7 revealed that, treating the seeds of watermelon plants with humic substances at two rats mixed with organic manures significantly increased the mean values of dry weight/plant (g) than those obtained with the untreated plants. In addition, using 4 kg from each one (humic and fulvic acids) combined with various organic manures investigated gave more pronounced values for dry weight/plant (g). in this respect the highest values were recorded with the plants treated with FYM + compost + CK and 4 kg humic acid + 4 kg fulvic acid after 35, 70 and 105 days during both seasons of the experiments.

Table 6. Leave area cm^2 as affected by different treatments during 2017 and 2018

Treatments	leaf area (cm^2)					
	2017			2018		
	35 days	70 days	105 days	35 days	70 days	105 days
Control	1623.33o	2018.33l	2460.67l	1648.33p	2073.33q	2671.67o
Farmyard manure (FYM)	1687.33n	2098.00kl	2581.33kl	1783.67o	2105.33p	2774.67n
FYM+2kg HA+2kg FA	1862.67l	2658.33c-f	2908.00g-k	1953.67m	2443.67l	3053.33l
FYM+4kg HA+4kg FA	1930.33jk	2411.00g-j	3015.00e-j	2023.00kl	2534.67jk	3167.00k
Compost	1712.00n	2145.00kl	2675.00jkl	1796.33o	2244.67o	2809.33n
Compost+2kg HA+2kg FA	2312.00c	2643.67c-f	3308.00c-g	2221.00e	2774.67e	3472.00e
Compost+4kg HA+4kg FA	1955.67ij	2443.00ghi	3053.00e-j	2054.00jk	2564.67ij	3205.67jk
Chicken manure (CK)	2164.00e	2706.00b-e	3384.67b-f	2276.33d	2844.00d	3554.67d
CK+2kg HA+2kg FA	1910.33k	2384.33hij	2981.33f-k	2004.67l	2506.67k	3222.33jk
CK+4kg HA+4kg FA	1976.67i	2472.67fgh	3090.33e-i	2074.00ij	2595.67hi	3244.33ij
FYM+Compost	2186.33e	2736.00bcd	3418.67b-e	2297.67d	2874.33d	3592.00d
FYM+Compost+2kg HA+2kg FA	2034.67gh	2504.33fgh	3128.00e-i	2106.00hi	2625.33h	3285.67hi
FYM+Compost+4kg HA+4kg FA	2021.33h	2535.00e-h	3168.67d-i	2125.67gh	2662.67g	3327.00ghm
FYM+CK	1786.00m	2236.67jk	2795.00i-l	1876.00n	2336.00n	2935.33fg
FYM+CK+2kg HA+2kg FA	2072.00f	2564.33d-h	3205.33d-h	2156.00fg	2696.67f	3367.00fg
FYM+CK+4kg HA+4kg FA	2076.33f	2596.00d-g	3244.00c-g	2181.67ef	2722.00f	3406.67f
Chicken manure (CK)+ compost	1812.00m	2264.00ijk	2832.33h-l	1906.00mn	2382.67m	2975.33m
CK+compost+2kg HA+2kg FA	2074.67f	2597.00d-g	3242.00c-g	2178.33ef	2722.67f	3403.00f
CK+compost+4kg HA+4kg FA	2054.67fg	2893.67ab	3612.00abc	2357.33c	3033.33b	3793.00b
FYM+CK+compost	2266.00d	2834.00abc	3540.67a-d	2378.00c	2975.33c	3716.33c
FYM+CK+compost+2kg HA+2kg FA	2404.33b	2977.67a	3784.00ab	2433.33b	2992.67c	3804.67b
FYM+CK+compost+4kg HA+4kg FA	2613.67a	3012.33a	3925.67a	2631.67a	3077.33a	3986.67a
LSD at 5%	31.86	199.19	406.53	48.84	31.65	61.98

HA: Humic acid **FA: fulvic acid**

Table 7. Dry weight/plant (g) as affected by different treatments during 2017 and 2018.

Treatments	Dry weight/plant (g)					
	2017			2018		
	35 days	70 days	105 days	35 days	70 days	105 days
Control	5.02q	6.93s	7.55t	5.64q	6.20p	8.54s
Farmyard manure (FYM)	5.45p	7.33r	8.26s	5.84p	6.54o	8.65s
FYM+2kg HA+2kg FA	7.06k	8.83l	11.06l	7.36k	9.23j	11.55l
FYM+4kg HA+4kg FA	7.65h	9.44i	11.82i	7.87hi	9.86g	12.33i
Compost	6.06o	7.57q	9.49r	6.36o	7.97n	9.96r
Compost+2kg HA+2kg FA	7.22j	9.03k	11.31k	7.56j	9.46i	11.84k
Compost+4kg HA+4kg FA	7.73gh	9.64h	12.03h	8.03gh	10.04g	12.55h
Chicken manure (CK)	6.24n	7.76p	9.74q	6.52no	8.14n	10.15q
CK+2kg HA+2kg FA	7.43i	9.24j	11.57j	7.75ij	9.65h	12.08j
CK+4kg HA+4kg FA	7.84g	9.83g	12.26g	8.19fg	10.27f	12.82g
FYM+Compost	6.35n	7.98o	9.97p	6.64n	8.34m	10.43p
FYM+Compost+2kg HA+2kg FA	8.02f	10.03f	12.52f	8.34f	10.44f	13.06f
FYM+Compost+4kg HA+4kg FA	8.75e	10.96e	13.72e	9.17e	11.45e	14.35e
FYM+CK	6.54m	8.21n	10.27o	6.86m	8.64l	10.76o
FYM+CK+2kg HA+2kg FA	8.74e	11.06e	13.86e	9.24e	11.55e	14.46e
FYM+CK+4kg HA+4kg FA	9.01d	11.24d	14.08d	9.44d	11.77d	14.72d
Chicken manure (CK)+ compost	6.74l	8.42m	10.52n	7.01lm	8.77kl	10.97n
CK+compost+2kg HA+2kg FA	9.15cd	11.43c	14.31c	9.55cd	11.95cd	14.95c
CK+compost+4kg HA+4kg FA	9.24c	11.55c	14.48c	9.66c	12.14bc	15.15b
FYM+CK+compost	6.85l	8.55m	10.74m	7.19kl	8.96k	11.23m
FYM+CK+compost+2kg HA+2kg FA	9.73b	11.93b	14.84b	9.94b	12.32b	15.12bc
FYM+CK+compost+4kg HA+4kg FA	10.13a	12.44a	15.25a	10.44a	12.74a	15.64a
LSD at 5%	0.16	0.17	0.21	0.19	0.19	0.19

HA: Humic acid **FA: Fulvic acid**

Significant increase in watermelon vegetative growth parameters (leave area and dry weight) was recorded with addition of different organic manure in individual way or combined together especially FYM + compost + chicken manure incorporated into the experimental soil. The results obtained is in conformity with the findings of Lawal, (2000) and Agba and Enga (2005) who detailed an increase in growth and yield component of watermelon in respond to increased level of fertilizer addition. The purpose for this expansion could be credited to the effective utilization of all available resources for plant and roots because of slow and continued supply of nutrients as well as more water absorption due to bigger amounts of nutrients in the soil with addition of different organic manures (Van-Averbeke and Yoganathan, 2003; Pimentel *et al.* 2005 and Kuntashula *et al.* 2006). Application of organic manure resulted in improved vegetative growth contrasted with the un-fertilized control plots and these seem to show that addition mix from used organic manures provided sufficient nutrients for maximum vegetative growth and the nutrients were partitioned towards stem elongation and leaf production. This effect had been previously observed by Mancy, 2013 and Dalorima *et al.* 2018)

Humic substances have been accounted for to impact the plant growth both directly and indirectly. The indirect effects of humic compounds have been ascribed to the improvement of soil physical, biological and chemical properties. Directly, these compounds seemed to be capable of affecting plant growth through the acceleration of respiratory processes, via increasing cell permeability and hormonal growth responses (Vaughan, 1974), or because of a combination of these processes. Indirectly, some plant hormone/ like substances that are present in the humic acids, exert a possible stimulating effect on growth and development of chlorophyll and proliferation of desirable soil micro/organisms (Liu *et al.*, 1998). Additionally, it could cause a developed root system (deeper and greater mass) and expanded stimulate of the plant growth due to hormones (Hopkins and Stark, 2003). These results are in an agreement with those obtained by Abd El-Rheem *et al.*, (2017) and Sarhan and Mohammed (2018).

2. Flowering stage:

2.1. Number of male flower/plant, number of female flower/plant and sex ratio ♂/♀:

Data presented in Table 8, showed the effect of the simple possible combination between the different sources of organic manures studied and humic substances compared to the untreated plant (control) on number of male and female flower/plant and sex ratio ♂/♀.

The obtained result clearly shows that; the different sources of organic manures significantly affected the number of male and female flower/plant and sex ratio ♂/♀. In spite of, the FYM + compost + CK application alone was recorded the highest values of number of female flower/plant, while number of male flower and sex ratio realized with FYM comparing with other treatments of organic manure and recorded (203, 25, 10.77) in 2017 for number of female, male flower/plant and sex ratio, respectively. Such effect was true in the season of 2018.

As for the effect of humic substances, data in Table 8, showed that stimulation action was happened due to an addition of both humic and fulvic mixed with different organic on watermelon plants as compared to the untreated plant (control). The highest values of these traits were realized for the plants treated with 4 kg humic acid + 4 kg fulvic acid for number of female flower, while number of male flower and sex ratio recorded with 2 kg humic acid + 2 kg fulvic acid. This trend was the same for all sources of organic manure. Moreover, FYM + compost + CK + 4 kg humic acid + 4 kg fulvic acid significantly recorded the highest values of number of female flower/plant, while number of male flower and sex ratio recorded the highest values with control compared to other treatments during both seasons of the experiments.

The significant in growth might be reflect to the number of flowers of watermelon plant contrasting with the un-fertilized plants. Watermelon treated with different source of organic manures over the control recorded in this study is because of the low fertility status of the experimental soil and agreed with the findings of (Sanni *et al*. 2013; Aniekwe and Nwokwu, 2015) that watermelon reacts well to organic manure which may contain essential nutrient elements related with high photosynthetic activities to have advanced incredible vegetative growth and root development, increment of meristematic and physiological activities in the plants due to adequate plant nutrient supply coupled with improved soil properties that resulted (John *et al* 2004).

As for the effect of humic substances found that these results agree with those reported by Feleafel and Mirdad (2014) who demonstrated that improvement flowering of tomato plants because of increasing the humic acid level resulting in an earlier flowering and an increase in the number of flowers per cluster.

Table 8. Number of flower (male and female) and sex ratio as affected by different treatments during 2017 and 2018

Treatments	Number of male flower/plant		Number of female flower/plant		Sex ratio ♂/♀	
	2017	2018	2017	2018	2017	2018
Control	235a	253a	16s	17o	14.70a	14.99a
Farmyard manure (FYM)	203b	210b	19r	19no	10.77b	10.90b
FYM+2kg HA+2kg FA	196c	208b	26klm	28ij	7.44d	7.34e
FYM+4kg HA+4kg FA	183d	198c	29hij	31f-i	6.26e	6.39ef
Compost	199bc	213b	21pqr	22mn	9.36c	9.76c
Compost+2kg HA+2kg FA	154f	167f	27jkl	29hij	5.65efg	5.76fgh
Compost+4kg HA+4kg FA	124hi	127lm	30ghi	32fgh	4.10ij	3.98ij
Chicken manure (CK)	179d	190d	20qr	23lm	8.82c	8.32d
CK+2kg HA+2kg FA	136g	147h	28ijk	30ghi	4.82hi	4.86hi
CK+4kg HA+4kg FA	123i	132kl	31fgh	33fg	3.92j	4.04ij
FYM+Compost	196c	212b	22opq	24lm	8.82c	9.00cd
FYM+Compost+2kg HA+2kg FA	171e	178e	32efg	34ef	5.31fgh	5.29gh
FYM+Compost+4kg HA+4kg FA	115j	122mn	33def	34ef	3.44jkl	3.62jkl
FYM+CK	142g	153g	23nop	25klm	6.09e	6.14fg
FYM+CK+2kg HA+2kg FA	130h	139ij	34cde	37de	3.78j	3.80jk
FYM+CK+4kg HA+4kg FA	125hi	135jk	35bcd	38cd	3.55jk	3.56j-m
Chicken manure (CK)+ compost	139g	143hi	24mno	26jkl	5.74ef	5.53fgh
CK+compost+2kg HA+2kg FA	127hi	135jk	36abc	39bcd	3.49jk	3.48j-m
CK+compost+4kg HA+4kg FA	109jk	113o	37ab	40abc	2.93kl	2.79lm
FYM+CK+compost	125hi	132kl	25lmn	27jk	4.94gh	4.89hi
FYM+CK+compost+2kg HA+2kg FA	111j	120n	38ab	41ab	2.96kl	2.92klm
FYM+CK+compost+4kg HA+4kg FA	104k	111o	38a	43a	2.72l	2.61m
LSD at 5%	6.03	5.97	2.52	3.17	0.73	0.96

HA: Humic acid FA: Fulvic acid

3. Yield and its components:

Data at Table 9, presented the effect of organic manures (FYM, compost and chicken manure) and humic substances (humic and fulvic acids) on average fruit weight/plot (kg), number of fruit/plant, dry matter% and total yield (ton/fed). Of watermelon fruits.

Concerning to the effect organic manures (FYM, compost and chicken manure) in individual way or mixed together on average fruit weight/plot (kg), number of fruit/plant, dry matter% and total yield (ton/fed) of watermelon fruits at Table 13, showed a significant increase in all parameters under study treated with different organic manures comparing with the untreated plant. The highest values of traits realized with the application of FYM + compost + CK comparing with the other treatments as 219.54 kg/plot, 3.25 fruit/plant, 7.33% and 18.92 ton/fed. for average fruit weight plot/kg, number of fruit/plant, dry matter% and total yield ton/fed of watermelon fruit in 2017. The same trend was happened in the second season of 2018.

As shown in the same Table, it could be noticed that the application of humic substances (humic and fulvic) at 2 or 4 kg for each one increased the previous traits under investigation. Such effect was reflected specially with the application of 4 kg humic + 4 kg fulvic mixed with different organic manure sources. Comparing with all treatments, the highest values were recorded with application of FYM + compost + CK + 4 kg humic + 4 kg fulvic during both seasons.

Table 9. Average fresh weight, number of fruit, dry matter% and total yield (ton/fed) as affected by different treatments during 2017 and 2018

Treatments	Average fresh weight of fruits/plot (kg)		Number of fruit/plant		Dry matter fruit %		Total yield ton/fed)	
	2017	2018	2017	2018	2017	2018	2017	2018
Control	177.52n	184.34u	5.64c	4.93c	6.23r	6.35i	15.24k	15.62m
Farmyard manure (FYM)	181.96mn	186.85u	4.86d	4.71d	6.56q	6.74i	15.36k	15.88m
FYM+2kg HA+2kg FA	226.76g-j	245.22n	4.07e	4.28ef	7.47jk	7.56gh	19.46g-j	20.33gh
FYM+4kg HA+4kg FA	246.28fgh	265.98k	4.07e	4.28ef	7.85gh	8.23f	21.22d-h	22.18f
Compost	187.77lmn	202.31t	4.09e	4.28ef	6.67pq	7.32gh	16.08jk	16.71l
Compost+2kg HA+2kg FA	199.81j-n	251.86m	3.50f	4.29ef	7.60ij	8.35f	20.03f-j	20.74g
Compost+4kg HA+4kg FA	253.24efg	273.02j	4.04e	4.25ef	8.00fg	8.42f	21.77c-h	22.62ef
Chicken manure (CK)	194.37k-n	210.50s	4.12e	4.34e	6.80op	7.47gh	16.64ijk	17.01kl
CK+2kg HA+2kg FA	239.48f-i	258.45l	4.06e	4.26ef	7.73hi	8.29f	20.25e-i	20.98g
CK+4kg HA+4kg FA	259.63def	279.90i	4.04e	4.23ef	8.14ef	8.51f	22.36b-g	23.14e
FYM+Compost	199.97j-n	216.01r	4.09e	4.26ef	6.93no	7.41gh	17.21ijk	17.47k
FYM+Compost+2kg HA+2kg FA	266.06c-f	287.90h	4.02e	4.22ef	8.26de	8.51f	16.29ijk	23.90d
FYM+Compost+4kg HA+4kg FA	239.65f-i	295.57g	3.53ef	4.24ef	8.37d	8.65ef	23.51a-f	24.16d
FYM+CK	206.20j-m	222.35q	4.09e	4.28ef	7.06mn	7.26h	17.79h-k	18.46j
FYM+CK+2kg HA+2kg FA	280.87b-e	303.58f	4.05e	4.28ef	8.58c	9.07de	24.05a-e	25.15c
FYM+CK+4kg HA+4kg FA	285.95bcd	308.83e	4.01e	4.16f	8.58c	9.07de	24.66a-d	25.79c
Chicken manure (CK)+ compost	212.73i-l	229.25p	4.05e	4.26ef	7.19lm	7.60gh	18.31h-k	19.02ij
CK+compost+2kg HA+2kg FA	294.11bc	317.18d	4.05e	4.26ef	8.66c	9.31cd	25.28abc	25.73c
CK+compost+4kg HA+4kg FA	301.60b	320.53c	4.06e	4.26ef	8.76bc	9.61c	25.78ab	26.80b
FYM+CK+compost	219.54h-k	237.06o	3.25f	3.34g	7.33kl	7.74g	18.92g-k	19.68hi
FYM+CK+compost+2kg HA+2kg FA	681.33a	765.80b	8.57a	9.78b	8.95b	10.13b	26.31ab	27.41b
FYM+CK+compost+4kg HA+4kg FA	693.26a	771.19a	8.12b	9.57a	9.24a	10.64a	27.12a	28.62a
LSD at 5%	28.49	3.33	0.53	0.18	0.20	0.46	3.99	0.69

HA: Humic acid **FA: Fulvic acid**

Results of the present study revealed that the addition of humic substances as soil amendments, increased the watermelon yield. The positive influences of humic acid on watermelon yield mainly due to its positive effect on number of fruits plant^{-1} and/or yield plant^{-1} as shown in the same Table. These additions may because of the vigorous growth of plants resulted in the hormone-like activities of the humic acid through their contribution in expanding, oxidative phosphorylation, photosynthesis, protein synthesis, various enzymatic reactions and antioxidant (Zhang and Schmidt, 2000). Likewise, HA has been claimed to advance plant growth by increasing cell layers permeability, photosynthesis and oxygen uptake, nutrient uptake, and root cell elongation (Nardi *et al.*, 2002). The current discoveries were in harmony with those outlined by Abou Zied *et al*. (2005) who found that utilization of humic acid improves the productivity and its quality of some crops grown on a sandy soil. Along these line, it tends to be concluded that availability of nutrients equally with humic and fulvic acid mixed with organic manures was responsible for improving watermelon yield. Also, Russo and Berlyn (1990) who concluded that, humic substances for example humic acid and fulvic acid, are the major components (65-70 %) of soil organic matter, increase plant growth enormously due to increasing cell layers permeability, respiration, photosynthesis, oxygen and phosphorus uptake, and supplying root cell growth, this in case soil added. These results are similar to other studies (El-Masry *et al.* 2014; Alkharpotly *et al*. 2017 and Al-Madhagi 2019)

4. Quality parameters:

Reducing sugar, non-reducing sugar and total sugar%:

Data illustrated in Table 10 indicated the effect of different organic manures and humic substances on reducing, non-reducing and total sugar% in fruit during 2017 and 2018.

Data presented in Table 10 indicated the effect of different sources of organic manures (FYM, compost and chicken manure or mixed) on reducing, non-reducing and total sugar% of watermelon fruit. It is clear from the data that, the average values of traits studied in watermelon fruits for plants treated with the different organic manure increased significantly with all application of individual way or mixed together comparing with the untreated plant. The highest values from the traits indicated with FYM + compost + CK over other treatments as (6.06, 4.53, 10.59% in the 1st season) and (6.51, 5.04 and 11.55% in the 2nd season), respectively for reducing, non-reducing and total sugar% of watermelon fruit.

As shown in Table 10 it could be observed that; a stimulation effect was happened on the mean values of the previously mentioned traits due to an application of the studied humic substances in two rats mixed with different organic manures comparing with the untreated plants (control). Such effect was more pronounced for the plants treated with 4 kg for each humic and fulvic acids coupled with FYM + compost + CK which recorded the highest values; 8.51, 6.84 & 15.34 % in 2017and 9.03, 7.74 and 16.76% in 2018, respectively for reducing, non-reducing and total sugar% of watermelon fruit.

Significant increasing in watermelon fruit sugar as affected by different organic manure may be due to the great growth and yield resulted from the application of organic especially addition mix of different used manures, which may be due to higher maintenance and availability of all the essential elements, which are needed for satisfactory growth, yield and quality of plants as well as improvement in soil biological and physical properties (Kamara and Lahai 1997 and Priyadarshani *et al*. 2013). Addition of organic improves the juice sugar of watermelon this is means that the manure utilized released some nutrients to the soil, which were in turn taken up by the crop (Okunlola *et al.* 2011). Organic fertilizers mainly the FYM + compost + CK had the highest results with regard to sugars (Massri and Labban 2014). This result tallies with that of (Diab *et al.* 2012; Abdel Nabi *et al.* 2014 and Shafeek *et al.* 2015).

Humic acid corrosive assumes a significant part in the percentage of plant dry matter. The current result takes a similar heading. Comparative discoveries had been indicated on different plants like soybean and peanut (Tan and Tantiwiramanond, 1983). Because of acts as a promoting of plant growth hormones, carbohydrates, vitamins and amino acids (Boehme *et al*. 2005 and Halime *et al*. 2011). The good impacts of humic acid on expanding concentration of protein in pods may be due to their impact on improving soil N-uptake and encourage K, Mg, Ca and P availability to plant root system (Seginer *et al.* 1998 and Pascual *et al.* 1999). The expansion in watermelon production (fruits yield and total, soluble, reducing and total sugar) attributed to humic and fulvic acids application increase the uptake of nutrient elements from the surrounding nutrient solution with a concomitant increase in physiological processes (Verónica *et al*., 2010). These results are similar to that reported by (Eshghi and Garazhian 2015; Alkharpotly *et al.* 2017 and Abd El-Rheem *et al.* 2017)

Table 10. Reducing, non-reducing and total sugar% as affected by different treatments during 2017 and 2018.

Treatments	Reducing sugar%		Non-reducing sugar %		Total sugar %	
	2017	2018	2017	2018	2017	2018
Control	5.16s	5.59i	3.43u	4.06m	8.59v	9.65m
Farmyard manure (FYM)	5.33rs	5.82hi	3.66t	4.12lm	8.99u	9.93m
FYM+2kg HA+2kg FA	6.18lmn	6.65e	4.65mn	5.17hi	10.83n	11.82i
FYM+4kg HA+4kg FA	6.57ijk	7.25d	5.12jk	5.47gh	11.68k	12.71h
Compost	5.42rs	6.04gh	3.82st	4.40jkl	9.24t	10.44l
Compost+2kg HA+2kg FA	6.31klm	7.20d	4.82lm	5.15i	11.12m	12.35h
Compost+4kg HA+4kg FA	6.70hij	7.43cd	5.24i	5.94ef	11.93j	13.36fg
Chicken manure (CK)	5.54qr	6.27fg	3.95rs	4.22klm	9.49s	10.49l
CK+2kg HA+2kg FA	6.44jkl	7.22d	4.96kl	5.33hi	11.40l	12.54h
CK+4kg HA+4kg FA	6.81ghi	7.46cd	5.43hi	5.73fg	12.23i	13.19g
FYM+Compost	5.68pqr	6.30fg	4.09qrgh	4.38jkl	9.77r	10.67kl
FYM+Compost+2kg HA+2kg FA	6.97fgh	7.61c	5.62gh	6.11de	12.59h	13.72ef
FYM+Compost+4kg HA+4kg FA	7.12efg	7.69c	5.80fg	6.34cd	12.91g	14.03e
FYM+CK	5.80opq	6.55ef	4.21pq	4.49jk	10.01q	11.04jk
FYM+CK+2kg HA+2kg FA	7.27def	8.19b	5.96ef	6.47c	13.23f	14.67d
FYM+CK+4kg HA+4kg FA	7.41cde	8.29b	6.15de	6.54c	13.56e	14.82d
Chicken manure (CK)+ compost	5.94nop	6.49ef	4.38op	4.66j	10.31p	11.14j
CK+compost+2kg HA+2kg FA	7.57cd	8.40b	6.31cd	7.00b	13.88d	15.40c
CK+compost+4kg HA+4kg FA	7.70bc	8.43b	6.47bc	7.05b	14.16c	15.48c
FYM+CK+compost	6.06mno	6.51ef	4.53no	5.04i	10.59o	11.55i
FYM+CK+compost+2kg HA+2kg FA	8.05b	8.75a	6.63b	7.42a	14.68b	16.17b
FYM+CK+compost+4kg HA+4kg FA	8.51a	9.03a	6.84a	7.74a	15.34a	16.76a
LSD at 5%	0.36	0.29	0.20	0.32	0.21	0.40

HA: Humic acid **FA: Fulvic acid**

CONCLUSION

Excellent yields of watermelon were obtained with all the manure types at the varying rates with comparing to the control plots, which recorded the lowest yield. All the manure type used increased the growth and yield of watermelon with different sources of manure fertilizer. This also proposes that higher yields could be expected from the soils of studied experiment if the manures of applications from different sources as FYM + compost + chicken manures. In addition of humic substances found that increase rate of humic and fulvic increased yield. So, it could be concluded that mix application of FYM + compost + chicken manures in presence of 4 kg to each humic and fulvic acid gave high significant yield with good quality under the same conditions.

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تأثير المصادر المختلفة للأسمدة العضوية و معدلات من الهيوميك و الفالفيك على النمو، التزهير، المحصول و مكوناتة لثمار البطيخ

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نفذت تجربة في مزرعة خاصه بمنطقة قلابشو، مدينة جمصه، محافظة الدقهلية، مصر. خلال الفترة المبكره للزراعة الصيفية من عامي 2017 و 2018 لدراسة تأثير إضافة مصادر مختلفة من الأسمده العضوية و مستويات مختلفة من حمض الهيوميك و الفالفيك على النمو و التزهير و المحصول و مكوناتة و السكر في ثمار البطيخ لصنف روميرو المطعم على شانتوسا. صممت تجربة كاملة العشوائية في 22 معاملة فى ثلاث مكررات و تألفت المعاملات من صور مختلفة من التسميد العضوى (سماد بلدى، كومبوست، سماد دواجن و خليط فيما بينهم) في وجود 2 و 4 كجم من حمض الهيوميك و الفالفيك لكل منهما مقارنة بالكنترول. أظهرت النتائج تحت التجربة وجود فروق معنوية بين المعاملات في معظم الصفات المدروسة . ووجد أن استخدام صور مختلفة من الاسمدة العضوية أدى الى زيادة معنوية في مساحة الأوراق، الوزن الجاف للنبات، عدد الازهار المؤنثة كذلك متوسط وزن الثمار ، عدد الثمار ، المادة الجافة و المحصول الكلي بالاضافة الى السكريات المختزلة و غير مختزلة و الكلية في ثمار البطيخ و سجلت أفضل النتائج عند استخدام خليط من السماد البلدى و الكمبوست و سماد الدواجن مع الاضافة الارضية 4 كجم من حمض الهيوميك و 4 كجم حمض الفالفيك خلال كلا الموسمين.