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Effect of Some Organic and Bio Fertilization Treatments in Presence of Chemical Fertilization on Growth, Chemical Composition and Productivity of Cantaloupe Plants

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Authors' contributions

This work was carried out in collaboration between both authors. Authors MHMM and MMEA designed the study, wrote the protocol and wrote the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Two field experiments were carried out during two successive seasons of 2012/2013 and 2013/2014 in a sandy soil at a private Sector Farm in El-Khatatba region, Minofia Governorate, Egypt to study the effect of some fertilization treatments (organic and biofertilizers) in presence of chemical fertilizer on growth, chemical composition, productivity and fruit quality of cantaloupe plants *(Cucumis melo* L.) cv. Gal 152. The experiment consisted of nine treatments as follows: T_1: Control (recommended dose of chemical fertilizer: Rd), T_2: Rd + 23.8 ton/ha compost + compost tea + biofertilizers, T_3: Rd + 47.6 ton/ha compost + compost tea+ biofertilizers, T_4: Rd + 23.8 ton compost + humic acid + biofertilizers, T_5: Rd + 47.6 ton/ha compost + humic acid + biofertilizers, T_6: Rd + 23.8 ton/ha compost + compost tea + EM, T_7: Rd + 47.6 ton/ha compost + compost tea + EM, T_8: Rd + 23.8 ton/ha compost + humic acid + EM and T_9: Rd + 47.6 ton/ha compost + humic acid + EM. The vegetative growth parameters of cantaloupe plant as plant height, number of

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branches/plant, fresh and dry weights of plant as well as leaf area increased by all fertilizer application treatments when compared with the control treatment (recommended dose of chemical fertilizer (T_1)) in the two seasons. Moreover, yield parameters of cantaloupe plant i.e., fruit diameter, fruit circumference, fruit fresh weight and total yield were increased greatly when compared with the control treatment in the two seasons. The highest cantaloupe yield was observed in T_5, followed by T_9 in the two seasons. Furthermore, all tested fertilizers treatments increased chemical composition parameters of cantaloupe leaves (total chlorophylls, total carbohydrates, N, P, K, Ca, Mg, Fe, Zn and Mn) as compared with the control treatment in the two seasons. In addition**,** fruit quality parameters of cantaloupe plant as affected by some fertilizer treatments are improved by all studied fertilizer treatments as compared with the control treatment in the two seasons.

Keywords: Cantaloupe; organic and biofertilizers; growth; chemical composition; yield and quality.

1. INTRODUCTION

As the population increases in Egypt passing the edge of ninety million capita, necessity to increase food production becomes a must. This increase in food production can be achieved by either increasing the cultivated land through land reclamation and/or increasing the production per unit area. Cantaloupe (*Cucumis melo* L.) is considered a very profitable vegetable crop with a promising yield in the new reclaimed soils. Cantaloupe is a very good source of vitamins A, C and β- carotene and can be used as fresh or juice fruit. Cantaloupe area was 29914 hectare with a total production of 886584 ton (Egypt, Ministry of Agric. Agric. Statistics, 2013/2014). The new reclaimed soils in Egypt are characterized by poor fertility, low holding capacity, high pH and/or high salinity in most cases. Therefore, addition of organic and biofertilizers, humic acid, compost tea and effective microorganism (EM) to these soils is a vital way to solve their problems.

Many investigators indicated that organic fertilizers could be applied as soil conditioners to increase soil organic matter contents in Egyptian sandy soils (less than 1% of organic matter) and also to improve nutrients availability and their physical, chemical and biological properties [1]. The use of compost enhanced soil properties such as water retention, aggregation, porosity, cation exchange capacity, fertility and microbial activities [2,3]. Compost is commonly applied one time before planting and this is not enough to supply the plants with their nutrient requirements. Therefore, supplying vegetable crops with liquid organic nutrients such as compost tea during the growing season in the irrigation system is an important agricultural practice [4]. In the modern terminology, compost tea is a compost extract produced from the fermented compost in water [5]. It is considered as a good source for organic matter and contains soluble plant nutrients, phytohormones and growth regulators, therefore it can be applied to the soil through irrigation systems. Moreover, it improves soil physical, chemical characteristics and soil microorganisms that have a direct or indirect effects on the plant rhizosphere as well as suppress some plant diseases pathogen [6,7,8].

Humic acid is highly important to both plant and soil through stimulating microbial activity. It is considered as a plant growth bio-stimulant and an effective soil conditioner, so it improves nutrients uptake, vegetative parameters of plants, chemical composition and leaf pigments. Furthermore, it activates the beneficial soil microorganisms and availability of soil nutrients, particularly in sandy soils, and may increase root growth in a similar manner to auxins [9]. Addition of humic acid at 5g/l positively increased vegetative growth, chemical composition of plant foliage, total fruit yield and its components and fruit quality of tomato plants [10].

Biofertilizers are microbial inoculants consisting of living cells of micro-organisms such as bacteria, algae and fungi either alone or in combination which may help in increasing vegetable crops productivity. It can improve plant growth directly through production of phytohormones as gibberellins, cytokinins and indole acetic acid, which are acting as growth promoters and indirectly through nitrogen fixation and production of bio-control agents against soil-borne phytopathogens and then increase the formation of metabolites that enhance the plant vegetative growth and the meristematic activity of tissues to induce good growth [11-13].

The nutritional requirements of macronutrients for vegetable plants were reported by many researchers. In this regard, [14] on squash, [15] on cucumber and [16] on chili (pepper) plant. The indicated that NPK fertilizers had an important

physiological and biochemical functions on structure of photosynthetic pigments, metabolism of crbohydrates and protein and these effects were reflected with significant increase in growth, chemical composition, yield and quality of the different plant species.

The present study aims to investigate the effects of some different fertilizer treatments including organic and biofertilizers in the presence of chemical fertilizer on the growth, chemical composition, yield and quality attributes of cantaloupe plants grown on a sandy soil.

2. MATERIALS AND METHODS

Two field experiments were carried out during two successive seasons of 2012/2013 and 2013/2014 in a sandy soil in private Sector Farm at El-Khatatba region, Minofia Governorate, Egypt to study the effect of some fertilizer treatments (organic and biofertilizers) in presence of chemical fertilizer on growth, chemical composition, productivity and fruit quality of cantaloupe plants *(Cucumis melo* L.) cv. Gal 152. Cantaloupe seeds were planted in 4th and 10th of November then transplanted under plastic low tunnels in the 1st and 5th of December. Individual transplants were planted at 50 cm apart on dig at one meter width with 15 meter long. Plot area was 1 X 15= 15 m^2. The drip irrigation system of GR 16 was used. Soil analyses were determined according to [17,18]. Physical and chemical properties of the used soil are shown in Table 1.

2.1 Organic Fertilizer Treatments

Organic manure (compost) was added at the rate of 23.8 and 47.6 ton/ha during soil preparation in both seasons. The chemical properties of the tested compost are presented in Table 2.

Humic acid was added three times at the rate of 9.52 kg/ha through drip irrigation, after two weeks from transplanting and two weeks by interval. Compost tea was added at the rate of 47.6 l/ha through drip irrigation three times.

2.1.1 Compost tea preparation

Compost tea was prepared by soaking 10 kg of mature plant compost with 100 liter of water + 100 ml molasses for 7days in special unit, and then attached to air pump and the aerator provided continuous flow of air bubbles to extract compost tea until completion of the fermentation process and extract color becomes light brown [19]. The chemical and microbiological properties of the used compost are listed in Table 3.

Table 1. Mechanical and chemical analyses of the used soil

Physical analysis		Chemical analysis			
		Cations (meq/l)		Anions (meq/l)	
Coarse sand	55.5%	Ca^{++}	1.24	CO_3^{--}	Zero
Fine sand	30.5%	Mg^{++}	0.86	HCO_3^-	2.01
Silt	6.0%	Na^+	1.91	Cl^-	1.53
Clay	8.0 %	K^+	0.10	SO_4^{--}	0.63
Texture class	Sandy				
		Soil pH	8.02		
		EC	0.41 dS/m		
		Organic matter	0.73 g/kg		
		Available N	14.1 mg/kg		
		Available P	6.83 mg/kg		
		Available K	108 mg/kg		

Table 2. Chemical properties of the used compost

Parameters determinations	Ec dS/m (1:5)	pH (1:5)	Total C %	Total N %	Total P %	Total K %	Ca %	Mg %	Total Fe (mg/kg)	Total Zn (mg/kg)	Total Mn (mg/kg)	Total Cu (mg/kg)	C:N ratio
Reading	2.19	7.53	26.56	1.21	0.73	1.48	1.84	0.83	1438	379	112.3	16.43	21.95

Table 3. Chemical and microbiological analyses of compost tea

Parameter	PH	EC (dS/m)	Total N%	Total p%	Total k%	Total count of bacteria (cfu/ml)	Total count of fungi (cfu/ml)	Total count of actinomycetes (cfu/ml)
Value	7.11	2.65	0.31	0.07	0.48	$8.4x10^6$	$7.5x10^4$	$1.3x10^5$

2.2 Bio Fertilizer Treatments

A mixture of nitrobein + phosphorein contained efficient strains of nitrogen fixing bacteria (*Azotobacter chroococcum*) + phosphate dissolving bacteria (*Bacillus megaterium var phosphaticum*) was obtained from the Department of Microbiology, Agric. Res. Center, Giza and added at the rate of 9.52 l/ha through drip irrigation three times at two weeks by interval, starting 17 and 22th of December in the first and second seasons, respectively. The strains were characterized by a good ability to infect its specific host plant and by its high efficiency in N-fixation and phosphate solubilizing. Effective microorganisms (EM) (contains photosynthetic bacteria + lactic acid + yeasts) was added at the rate of 9.52 l/ha through drip irrigation three times. Efficient microbes (EM) was gained from Department of Microbiology, Agric. Res. Center., Giza, Egypt.

2.3 Chemical Fertilizer Treatments

The plants were received chemical fertilizers at the recommended doses of NPK (166.6:261.8:404.6 N: P_2O_5 : K_2O actual Kg/ha.) in the forms ammonium nitrate 33.5 N%, phosphoric acid 80% P_2O_5 and potassium sulphate 48% K_2O. Chemical fertilizers doses were added through drip irrigation system during the two seasons of this study.

Therefore, the present study consisted of nine treatments as follows:

1- T_1: Control (recommended dose of chemical fertilizer: Rd)
2- T_2: Rd + 23.8 ton/ha compost + compost tea + biofertilizers
3- T_3: Rd + 47.6 ton/ha compost + compost tea+ biofertilizers
4- T_4: Rd + 23.8 ton/ha compost + humic acid + biofertilizers
5- T_5: Rd + 47.6 ton/ha compost+ humic acid + biofertilizers
6- T_6: Rd + 23.8 ton/ha compost + compost tea + EM
7- T_7: Rd + 47.6 ton/ha compost + compost tea + EM
8- T_8: Rd + 23.8 ton/ha compost+ humic acid + EM
9- T_9: Rd + 47.6 ton/ha compost+ humic acid + EM

All standard agricultural practices other than experimental treatments were applied according to the recommendations of the Ministry of Agriculture, Egypt.

2.4 Measurements

Vegetative growth characters; plant height, number of branches/plant, leaf area, fresh and dry weights of plant at 70 days after transplanting were measured. Chemical constituents of plant foliage; total chlorophylls were calorimetrically determined in leaves according to the method described by [20], total carbohydrates, nitrogen, phosphorus and potassium were determined according to [21-24], respectively. Concentrations of Ca, Mg, Fe, Zn, and Mn were determined in cantaloupe leaves by atomic absorption spectrophotometer as described by [25]. Yield parameters; average weight of individual fruit was calculated as an average of individual fruit of the third picking. The same fruits were used to measure fruit diameter and fruit circumference, while total yield was estimated by weighed all harvested ripe fruits/ha during both seasons. Fruits quality parameters; total soluble solids % (TSS) was determined by using hand refractometer. Total sugars (mg/g F.W) were determined colormetrically in ripe fruits by the method described by [26], V.C (mg/100g F.W), Beta carotene (µg/g F.W) were determined according the method described by [27], external firmness, internal firmness were determined in a random sample by using the Effegi firmness tester with an 7/16" plunger (Effegi 48011 Alfonsine, Italy). Fruit firmness was expressed as pounds/square inch (lb/in^2)

2.5 Statistical Analysis

The obtained data in both seasons of study were subjected to analysis of variance as a simple experiment in randomize complete block design. LSD was used to evaluate the differences between means according to [28].

3. RESULTS AND DISCUSSION

3.1 Vegetative Growth Parameters

The vegetative growth parameters of cantaloupe plant cv. Gal 152 significantly increased by all fertilizer application treatments when compared with the control treatment; recommended dose of chemical fertilizer (T_1) during the two seasons of study as shown in Table 4. Moreover, the tallest plant was recorded in T_7, followed by T_9 and T_3 in the two seasons. The highest values of branches number/plant, fresh and dry weights of plant

were recorded in T_5, followed by T_9 and T_3 treatments in the two seasons. The highest values of leaf area of cantaloupe plant were recorded by T_3 treatment, followed by T_7 and T_5 treatments in the two seasons. These results are in agreement with those reported by [29-31] on cantaloupe, [14] on squash, [15,32] on cucumber, [16] on pepper and [33] on wheat, faba bean and onion plants.

3.2 Chemical Composition of Plant Foliage

Data in Tables 5 and 6 indicate that all tested fertilizers treatments increased leaf chemical composition parameters of cantaloupe plants compared with the control treatment with significant differences in most cases in the two seasons. In addition, the highest values of leaf total chlorophylls (264.3 and 272.2 mg/100g f.w), total carbohydrates (12.68 and 13.34%), potassium (2.83 and 2.94%), Mg (0.314 and 0.323%) and Mn (54.3 and 56.8 ppm) were scored by T_9 treatment in the first and second seasons, respectively, followed by T_5 and T_7 treatments without significant difference between them in most cases. The highest values of leaf nitrogen (1.46 and 1.58%) and Fe (192.4 and 183.4 ppm) were registered by T_5 treatment in the first and second seasons, respectively. Also, T_9 and T_3 treatments caused high increments in this regard in the two seasons. Furthermore, the highest values of leaf phosphorus (0.294 and 0.286%) and Ca (0.892 and 0.824%) were scored by T_3 treatment, followed by T_7 and T_5 treatments in the two seasons, respectively. The highest value of leaf Zn content (68.21 and 62.46 ppm) was scored by T_7 in the first and second seasons, respectively. Regardless control treatment, the lowest values of leaf chemical composition were resulted from the treatments that contained compost at 23.8 ton/ha in the two seasons. These results are similar with those reported by [29,30,31] on cantaloupe, [14] on squash, [15,32] on cucumber, [16] on pepper and [33] on wheat, faba bean and onion plants.

3.3 Yield Parameters

Data in Table 7 show that yield parameters of cantaloupe plant significantly increased when compared with the control treatment in the two seasons. Moreover, the highest values of fruit diameter (16.86 and 17.19 cm), fruit circumference (58.34 and 64.30 cm) and fruit fresh weight (1216 and 1286 g) were registered by T_9 treatment, followed by T_5 treatment in the two seasons, respectively. In addition, T_3 and T_7 treatments showed high significant increments in this respect. Irrespective control plants, the lowest values of these parameters were gained by the treatments that contained compost at 23.8 ton/ha (T_2, T_4, T_6 and T_8) in the two seasons. However, T_5 treatment was the most effective treatment for producing the highest yield (61.23 and 64.83 ton /ha), followed by T_9 treatment, which caused 57.54 and 61.71 ton/ha in the first and second seasons, respectively. Furthermore, T_3 and T_7 treatments caused high significant increases in cantaloupe yield (52.21 and 50.38 ton/ha) in the first season and 57.47 and 55.35 ton/ha in the second one, respectively. The differences between the aforementioned two treatments did not reach the level of significant in the two seasons. On the contrary, the lowest cantaloupe yield (41.07 and 43.14 ton/ha) was gained by T_1 treatment, followed by T_4 and T_6 treatments in the two seasons. These results are in agreement with those reported by [29,30,31] on cantaloupe, [14] on squash, [15,32] on cucumber, [16] on pepper and [33] on wheat, faba bean and onion plants.

3.4 Fruit Quality Parameters

Results of Table 8 reveal that all studied fertilizer treatments improved fruit quality of cantaloupe plant as compared with the control treatment in the two seasons. However, T_9 treatment was superior for producing the highest fruit TSS % and total sugars %, while the highest fruit Beta carotene was gained by T_3 treatment, followed by T_5 and T_9 treatments. The highest external and internal fruit firmness were scored by T_4 treatment, followed by T_8 treatment. This trend was true only in the first season, while in the second one T_6 treatment showed its superiority in inducing the highest fruit TSS %, total sugars % and Beta carotene content. The highest fruit V.C content was scored by T_8 treatment, followed by T_6 and T_4 treatments. While, the highest external and internal fruit firmness of fruit were registered by T_2 treatment, followed by T_7 and T_8 treatments. The obtained results go on line with those reported by [29,30,31] on cantaloupe, [14] on squash, [15,32] on cucumber, [16] on pepper and [33] on wheat, faba bean and onion plants reported similar results.

Table 4. Effect of some organic and bio fertilizer treatments in presence of chemical fertilizer on vegetative growth parameters of cantaloupe plants cv. Gal 152 during the two seasons of 2012/2013 and 2013/2014

Treatments	First season (2012/2013)					Second season (2013/2014)				
	Plant length(cm)	No. of branches/Plant	Plant fresh weight(g)	Plant dry weight(g)	Leaf area(cm^2)	Plant length(cm)	No. of branches/plant	Plant fresh weight(g)	Plant dry weight(g)	Leaf area(cm^2)
T_1: Control:recommended dose (RD)	342.6	4.29	3164	446.1	141.8	331.9	4.35	3208	484.4	132.6
T_2:RD+23.8 toncompost+compost tea + Bio	357.3	4.96	3581	508.5	148.3	356.2	4.84	3381	513.9	146.4
T_3: RD+47.6 ton compost +compost tea+ Bio	376.2	5.94	3682	526.5	184.3	371.0	6.17	3714	571.6	192.4
T_4: RD+23.8 ton compost +humic +Bio	359.4	5.46	3509	501.7	152.0	364.2	5.78	3412	525.4	161.4
T_5: RD+47.6 ton compost+humic+Bio	369.8	6.43	3841	564.6	173.6	368.7	6.76	3978	620.5	176.2
T_6: RD+23.8 ton compost +compost tea +EM	362.3	4.72	3473	500.1	162.4	360.7	5.03	3480	532.4	156.2
T_7: RD+47.6 ton compost +compost tea +EM	389.4	5.70	3605	522.7	178.9	373.4	5.97	3682	563.3	186.5
T_8: RD+23.8 ton compost+humic+EM	365.0	5.14	3317	484.2	169.4	354.6	5.41	3505	532.7	142.3
T_9: RD+47.6 ton compost+humic+EM	381.6	6.18	3794	550.1	171.8	369.6	6.59	3816	591.4	169.2
LSD at 5%	12.3	0.43	126	38.2	8.4	16.4	0.41	114	21.7	9.7

Table 5. Effect of some organic and bio fertilizer treatments in presence of chemical fertilizer on chemical constituents of cantaloupe plants cv. Gal 152 during the two seasons of 2012/2013 and 2013/2014

Treatments	First season (2012/2013)					Second season (2013/2014)				
	Total chlorophylls mg/100 g f.w	Total carbohydrates%	N%	P%	K%	Total chlorophylls mg/100 g f.w	Total carbohydrates%	N%	P%	K%
T_1: Control: recommended dose (RD)	216.8	8.29	1.12	0.214	2.16	224.6	9.38	1.19	0.223	2.24
T_2:RD+23.8 toncompost+compost tea + Bio	238.4	9.64	1.19	0.246	2.29	249.1	11.84	1.38	0.241	2.39
T_3: RD+47.6 ton compost +compost tea+ Bio	241.7	11.26	1.38	0.294	2.34	251.3	12.17	1.45	0.286	2.61
T_4: RD+23.8 ton compost +humic +Bio	241.5	9.84	1.24	0.256	2.31	246.1	10.94	1.31	0.243	2.35
T_5: RD+47.6 ton compost+humic+Bio	259.6	12.14	1.46	0.276	2.74	268.0	13.21	1.58	0.264	2.82
T_6: RD+23.8 ton compost +compost tea +EM	236.4	10.16	1.29	0.243	2.36	243.2	10.10	1.32	0.275	2.38
T_7: RD+47.6 ton compost +compost tea +EM	248.9	11.83	1.32	0.287	2.41	259.3	12.76	1.41	0.246	2.67
T_8: RD+23.8 ton compost+humic+EM	242.1	10.84	1.25	0.252	2.39	239.8	11.26	1.36	0.248	2.41
T_9: RD+47.6 ton compost+humic+EM	264.3	12.68	1.41	0.262	2.83	272.2	13.34	1.52	0.257	2.94
LSD at 5%	24.8	1.23	0.12	0.014	0.13	18.6	0.71	0.11	0.012	0.12

Table 6. Effect of some organic and bio fertilizer treatments in presence of chemical fertilizer on chemical constituents of cantaloupe plants cv. Gal 152 during the two seasons of 2012/2013 and 2013/2014

Treatments	First season (2012/2013)					Second season (2013/2014)				
	Ca%	Mg%	Fe (ppm)	Zn(ppm)	Mn(ppm)	Ca%	Mg%	Fe (ppm)	Zn(ppm)	Mn(ppm)
T_1: Control: recommended dose (RD)	0.534	0.213	132.2	41.32	36.41	0.574	0.214	114.7	38.43	37.96
T_2:RD+23.8 toncompost+compost tea + Bio	0.649	0.246	153.2	52.47	43.36	0.641	0.254	146.2	52.36	42.64
T_3: RD+47.6 ton compost +compost tea+ Bio	0.892	0.287	181.7	61.42	51.97	0.824	0.298	170.4	56.44	51.80
T_4: RD+23.8 ton compost +humic +Bio	0.676	0.254	164.2	58.15	42.63	0.681	0.301	154.0	49.60	47.25
T_5: RD+47.6 ton compost+humic+Bio	0.814	0.304	192.4	63.17	53.42	0.736	0.314	183.4	58.92	54.23
T_6: RD+23.8 ton compost +compost tea +EM	0.716	0.263	171.2	57.24	46.34	0.694	0.263	141.3	46.06	46.14
T_7: RD+47.6 ton compost +compost tea +EM	0.843	0.294	179.0	68.21	51.25	0.819	0.306	163.7	62.46	48.65
T_8: RD+23.8 ton compost+humic+EM	0.735	0.276	173.6	56.35	49.26	0.681	0.281	149.0	42.45	52.62
T_9: RD+47.6 ton compost+humic+EM	0.784	0.314	186.3	64.33	54.38	0.706	0.323	176.8	60.53	56.84
LSD at 5%	0.112	0.028	14.1	8.14	4.13	0.11	0.071	18.3	7.26	3.24

Table 7. Effect of some organic and bio fertilizer treatments in presence of chemical fertilizer on total yield of cantaloupe plants cv. Gal 152 during the two seasons of 2012/2013 and 2013/2014

Treatments	First season (2012/2013)				Second season (2013/2014)			
	Fruit diameter(cm)	Fruit circumference(cm)	Fruit fresh weight(g)	Total yield (ton/ha.)	Fruit diameter(cm)	Fruit circumference(cm)	Fruit fresh weight(g)	Total yield (ton/ha.)
T_1: Control: recommended dose (RD)	13.81	36.14	828	41.07	14.26	37.93	848	43.14
T_2:RD+23.8 toncompost+compost tea + Bio	14.21	38.61	863	45.83	14.52	39.11	896	50.38
T_3: RD+47.6 ton compost +compost tea+ Bio	15.83	48.30	1032	52.21	16.13	50.20	1064	57.47
T_4: RD+23.8 ton compost +humic +Bio	14.23	39.41	894	45.62	14.68	40.81	918	49.50
T_5: RD+47.6 ton compost+humic+Bio	16.41	52.19	1184	61.23	17.06	60.34	1245	64.83
T_6: RD+23.8 ton compost +compost tea +EM	14.62	41.34	900.4	45.31	14.95	43.26	946	50.07
T_7: RD+47.6 ton compost +compost tea +EM	15.17	45.16	986	50.38	16.54	53.02	1192	55.35
T_8: RD+23.8 ton compost+humic+EM	14.83	41.37	901.8	46.31	15.19	48.36	992	50.86
T_9: RD+47.6 ton compost+humic+EM	16.86	58.34	1216	57.54	17.19	64.30	1286	61.71
LSD at 5%	0.31	1.35	31.4	2.66	0.24	1.13	42.3	3.17

Table 8. Effect of some organic and bio fertilizer treatments in presence of chemical fertilizer on chemical fruit quality of cantaloupe plants cv. Gal 152 during the two seasons of 2012/2013 and 2013/2014

Treatments	First season (2012/2013)						Second season (2013/2014)					
	TSS%	Total sugars (mg/g F.W)	V.C (mg/100g F.W)	Beta carotene (µg/g F.W)	External firmness(lb/in^2)	Internal firmness(lb/in^2)	TSS%	Total sugars (mg/g F.W)	V.C (mg/100g F.W)	Beta carotene (µg/g F.W)	External firmness(lb/in^2)	Internal firmness(lb/in^2)
T_1: Control: recommended dose (RD)	9.28	54.17	28.36	26.42	16.24	6.93	9.13	53.21	26.13	23.64	15.97	6.14
T_2:RD+23.8 toncompost+compost tea + Bio	10.36	57.83	29.19	26.83	18.26	8.18	10.19	57.10	27.14	24.83	18.67	8.96
T_3: RD+47.6 ton compost +compost tea+ Bio	9.64	56.30	29.26	27.24	16.71	7.65	9.81	55.82	26.82	24.56	17.13	7.94
T_4: RD+23.8 ton compost +humic +Bio	10.21	57.19	28.42	26.75	19.34	9.67	10.02	56.19	27.23	23.91	17.38	7.37
T_5: RD+47.6 ton compost+humic+Bio	9.76	56.16	29.46	27.12	16.93	7.20	9.58	55.94	26.45	24.16	17.27	6.43
T_6: RD+23.8 ton compost +compost tea +EM	9.93	56.81	28.64	26.63	17.80	8.48	10.81	57.26	27.62	24.93	17.76	8.18
T_7: RD+47.6 ton compost +compost tea +EM	9.82	56.94	29.67	26.56	17.13	7.94	9.36	55.43	26.34	24.63	18.14	8.70
T_8: RD+23.8 ton compost+humic+EM	10.14	57.04	28.90	26.81	18.64	9.26	10.06	56.34	27.81	24.92	16.82	6.95
T_9: RD+47.6 ton compost+humic+EM	10.94	58.91	29.34	26.93	17.35	7.62	9.28	54.93	26.56	24.74	16.42	6.82
LSD at 5%	0.86	2.14	N.S	N.S	1.34	0.46	0.74	2.64	N.S	N.S	1.13	0.81

The obtained results of this study on cantaloupe plants may be due to the role of the used fertilization treatments in growth and development of the plants. The use of N-fixing bacteria (nitrobein) that contained Azotobacter and Azospirillum had high ability to fix the atmospheric nitrogen and to release certain phytohormones such cytokinins, gibberellins and auxins, which could improve the growth of cantaloupe plants through increasing absorption of nutrients and enhancing photosynthesis process [34]. Using microorganisms as biofertilizers may affect the integrity of growing cantaloupe plants by one mechanism or more such as nitrogen fixation and production of growth promoting substances or organic acids, enhancing nutrients uptake or protection against plant pathogens [35]. Also, N-fixers could synthesize stimulatory compounds such as gibberellins, cytokinins and IAA. These materials act as growth regulators with high efficiency in increasing root surface area, root hair branching and absorption of nutrients from the soil [36,37]. Furthermore, the use of phosphate dissolving bacteria (phosophorein) as a bio-fertilizer had important role in improving growth and development of many plant species including vegetable crops ones. Establishment of a strong root system is related to the level of available phosphate in the soil. Phosphate dissolvers or vesicular arbuscular mycorrhizae and silica bacteria are capable of converting tricalcium phosphate to monocalcium phosphate (ready for plant nutrition). Phosphate also increased mineral uptake and water use efficiency [35]. Moreover, addition of organic compounds such as compost, humic acid and compost tea as fertilizers could lead to marked reduction in soil pH, which caused high solubility of nutrients for cantaloupe plants. In some cases, organic materials might act as slow release fertilizers. Recently, on the way of sustainable agriculture with minimum effects, the use of organic manures (compost, humic acid and compost tea) as natural soil amendments is recommended to replace the soluble chemical fertilizers. They improved the structure of weak-structured sandy soils and increased their water holding capacity. Also, they enhanced soil fertility, root development, and activities of micro-organisms, particularly those involved in mineralization [38]. **I**t is important to refer to the physiological roles of nitrogen, phosphorus and potassium in plant growth and development. Plant supplement with these macronutrients in form of fertilizers is necessary because the soil is usually lacked them due to plant removal, leaching or they are not readily available for plants. Therefore, such addition of well-balanced NPK fertilizers insured high productivity and chemical constituents of cantaloupe plants.

The role of NPK fertilizers in enhancing vegetative growth characters, improving growth, yield component as well as increasing the chemical constituents of this plants could be explained by recognizing their fundamental involvement in the very large number of enzymatic reaction. NPK reflected directly in increasing contents of total carbohydrates, total sugars and total free amino acids as well as NPK % in the leaves and this played a vital role in enhancing all vegetative growth traits, yield and chemical composition of cantaloupe plants [39].

4. CONCLUSION

It is preferable from the previous results that fertilizing cantaloupe plants with 47.6 ton compost/ha supplemented with humic acid or compost tea and inoculated them with biofertilizers in the presence of chemical fertilizer caused high enhancements in growth, chemical composition and productivity of this plant. Additionally, plants that received 23.8 ton compost/ha could give the above- mentioned prospective traits when enriched with humic acid or compost tea and inoculated with biofertilizer in presence of chemical fertilizer treatments.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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