Scientific Journal of Agricultural Sciences 2 (2): 29-37, 2020
Print (ISSN 2535-1796) / Online (ISSN 2535-180X DOI: 10.21608/sjas.2020.42358.1037

Response of watermelon (*Citrullus lanatus*) to plant compost, kitchen wastes and chicken manure composted with PGPR microbes as Bio-Organic fertilizers

Mona M. Yousry[1] and Amal K.Abou El-Goud[2]*

[1]Department of Plant Production, Vegetable, Faculty of Agriculture, Saba Basha, Alexandria University, Egypt – and [2]Department of Botany, Organic Agriculture, Faculty of Agriculture , Damietta University, Egypt
*Corresponding author email: **amalabouelgoud805@gmail.com**

Received on: 9/9/2020 **Accepted on: 24/11/2020**

ABSTRACT

Field experiments in two different locations were conducted at the Faculty of Agriculture, (Saba-Basha) - Alexandria University, during summer season of 2018/2019. The main objective was to investigate the effectiveness of different combinations of compost types on yield and quality of watermelon (cv.Skata F1 hyprid). The study was conducted with randomized complete block design with three replicates. Seven treatments were carried out in this investigation i.e. (T1-Jojoba leaves compost, T2-Compost A,T3-Compost B, T4-Compost C, T5-Compost D, T6-Compost E and T7- Control treatment (R100% NPK). The effects of the treatments on the growth and yield of watermelon were determined. Application of different types of compost increased the vine length, number of leaves, number of branches, number of fruits/plant, average fruit weight, fruit length, fruit diameter, mineral contents of leaves and fruits and improved total fruit yield. The obtained results indicated generally that application of chicken manure (T6) produced the highest values of all yield and its components and chemical composition of watermelon plants during both locations compared with the inorganic treatment. Also,Jojoba leaves compost (T1) and compost B (100% Compost A + PGPR) gave the highest mean values of the chlorophyll content in leaves character. In addition to Compost C (50% Compost A + 50% Chicken manure) gave the best results in mineral content of leaves characters. The findings in this study strongly recommended that chicken manure, beneficial microbes (PGPR), plant composted residues and kitchen wastes would be advantage if the farmer's target is to maximize watermelon yield.

KEYWORDS: Jojoba leaves compost ; Aerated compost; Chicken manure; PGPR and watermelon.

1. INTRODUCTION

Watermelon (*Citrullus lanatus*) is an important *cucurbitaceae* family. It contains high amount of water and significant amounts of sugar, vitamins A, B and C (Maundu *et al*., 2009). In Africa, in 2017, watermelon accounted for 5.4% of the harvested area devoted to vegetable production, contributing 5% to world watermelon production. The production of watermelon in Egypt is (1.7 million units yearly), eighth in the world. Currently, Africa, as a whole, is the third producer of watermelon in the world (Anonymous, 2019).

Plant growth-promoting rhizobacteria (PGPR) considered as the second category and applied directly on seed surface that they will colonize the plant roots and protect them from various plant pathogens. This group exemplifies the strategy of augmentative application where the antagonists persist with plant throughout the life of host and rapidly increase the population of the benefit microorganisms in the rhizosphere around the root (Cook 1993; Vassilev *et al*., 2015; Calvo *et al*., 2014).

Combinations of composting substrates wide ranges of substrates have been used for commercial production of organic fertilizer formulations (Assunta *et al*., 2020). Agricultural wastes would be economically viable, while other organic various substrates have been developed for economical target for field application such as molasses, sorghum seeds, powdered ryegrass seeds, wheat bran, sawdust, sugarcane and maize straw, molasses-yeast medium, tapioca rind substrate, alginate wheat bran, coconut coir pith, vermiculite-wheat bran, banana pseudo-stem pineapple peeling compost, vermicompost, etc. (Ceglie *et al*., 2016; Khandaker *et al*., 2017).

Jojoba leaves is considered as a promising oil crop and is cultivated for diverse purposes in many countries. The jojoba seeds and leaves produces unique high-quality oil with a wide range of applications such as medical and industrial-related products. Jojoba leaves compost reach in mineral content that is benefit to organic farming application (Al-Obaidi *et al.*, 2017).

The purpose of this study is to obtain the excellent potential organic farming management by addition the combinations of different compost types on vegetable growth and yield of watermelon (*Citrullus lanatus*,) cv.Skata F1 hyprid cultivar compared with add chemical N,P and K fertilizers. In order to

decrease soil chemical pollutions and environmental protection.

2. MATERIALS AND METHODS

2.1. Experimental locations and arrangement

Two locations of field experiments were conducted at the Faculty of Agriculture (Saba-Basha), Alexandria University, during the summer season of 2018/2019. The two locations of the experimental soil was sampled at the beginning of the growing season 2018, as well as different types of compost were analyzed for some physical and chemical properties according to the methods outlined in Page *et al.*, (1982) as shown in Table (1 and 2).

Table 1. Some physical and chemical properties of the two different locations of experimental field at growing season 2018/2019.

Properties	location 1	location 2	Unit
Sand	73.5	74.5	%
Silt	12.0	13.0	%
Clay	14.5	12.5	%
Textural Class	Sandy Loam		
pH (1:2)	8.7	8.7	-
EC (1:2)	0.324	0.332	ds/m
O.M.	0.50	0.65	%
O.C.	0.31	0.35	%
C/N ratio	29.5/1	32.8/1	-
$CaCO_3$	20.8	20.5	%
Nutrients available (mg/kg)			
Nitrogen	96.80	117.5	(mg/kg)
Phosphorus	30.08	20.25	(mg/kg)
Potassium	658.3	606.25	(mg/kg)

Table2 Chemical analysis of different tested types of compost during 2018/2019 season.

Parameters	Compost.A	Compost.B	Compost.C	Compost.D	Compost.E	Unit
pH (1:10)	8.3	8.2	8.3	8.5	7.7	-
EC (1:1Water)	1.16	1.17	0.73	0.78	1.32	ds/m
O.M	3.80	6.88	2.35	4.50	4.50	%
O.C	2.20	3.99	1.36	2.61	2.61	%
C/N	6.8:1	22.2:1	15.1:1	10.9:1	17.4:1	%
Total Nitrogen	1.38	1.18	1.09	1.24	1.15	%
Phosphorous	2.64	2.36	2.25	2.37	2.36	%
Potassium	3.58	3.50	3.37	3.53	3.42	%

2.2. Experimental materials

Programe of organic fertilizers in Watermelon (cv. Skata F1 hyprid) were carried out in two locations at the Faculty of Agriculture (Saba-Basha), Alexandria University; during summer season of 2018/2019. Seeds were sown on 9th of March at two locations. Seven treatments were carried out in this investigation i.e.:

T_1-Jojoba leaves compost

T_2- Compost A

T_3- Compost B

T_4- Compost C

T_5- Compost D

T_6- Compost E

T_7- Control treatment (recommended doses of chemical fertilizer N, P and K).

2.2.1. The composition and amount of each material:

a. Jojoba leaves compost was added at 6 ton/fed.

b. Compost A : Aerated compost extracts that are brewed with biological and non-biological materials such as (rice straw- rice peels- banana peels- egg shells- coffee and tea- leaves and seeds of moringa- peatmoss- hot red rost- egg cartones and newspapers- plant composted residues - molasses- garlic- salicylic acid) to maximize microbial growth (Ingham 2000). They are brewed in an aerobic environment for two months period that may be further extended (Assunta et al., 2020), fermentation parameters can influence the composition and population of microbial species. It was added at 7 ton/fed

c. Compost B : Consist of (100% Compost A + PGPR), PGPR: Plant Gowth Promoting Rhizosphere consist of: (Bacillus subtilus, Trichoderma hauzarium, Azotobacter, Azospirillum and Pseudomonas fluorescence), it was added at 6 ton/fed.

d. Compost C : Consist of (50% Compost A + 50% Chicken manure) was added at 6 ton/fed.

e. Compost D : Consist of (100% Compost C + PGPR) was added at 6 ton/fed.

f. Compost E : Consist of (100% Chicken manure) was added at 4 ton/fed.

g. 7- Control (recommended doses of chemical fertilizer N, P and K consist of Ammonium sulphate 33.5% = 350 kg/fed. + Super calcium phosphate 15.5%=300 kg/fed. + Potassium sulphate 48% =250 kg/fed).

2.2.2. Source of PGPR; Plant Growth Promoting Rhizobacteria; was obtained from Cairo MIRCEN- Fac. Agric., Ain Shams Univ., Cairo Egypt. It was mixed with the seeds of watermelon 2 hours before culture.

2.2.3. Experimental design

Two locations experiments were carried out in a randomized complete blocks design with three replications (RCBD). Total plot area was (3.5m length × 1.6m diameter) and the distance between two plants within row was 66 cm. Each plot included nine plants .Total amount of organic fertilizers were applied prior to planting and thoroughly mixed to the soil during plowing from 21 days before sowing on 15th of February.

2.3. Irrigation and organic - related protection

Irrigation was added three times weekly and applied by drip-irrigation system. Weeds were controlled by hand-howling once a week after sowing, there were organic pesticides programme by using (Ashok) the neem oil extraction as a foliar applications on leaves at level: 3 cm/ L for every two weeks after 45 days from sowing and continued to the end of the harvest at 28th June of two locations to increase the defense of the plants against the insects in addition to cover the watermelon plants with net to protect them from insects (Emmanuel and Maerere 2018).

2.4. Vegetative growth characters

Six plants were randomly taken from each experimental unit for determination of growth characteristics. Vine length (cm), number of leaves/ plant and number of branches/plant.

2.5. Yield and its components

Total yield consist of two pickings, the first one was at 5th of June and the second one was after three weeks from the first one at 28th of June. Yield characters were measured as Number of fruits/plants after 60 days from sowing, Number of fruits/plants at harvest, fruit length (cm) , fruit diameter (cm), average fruit weight (kg), total yield (Kg/plant) and total yield (Kg/feddan).

2.6. Plant chemical analysis

2.6.1. N,P,K contents of leaves and fruits

In order to determine the mineral contents of plant leaves and fruits, dry samples of leaves and fruits were finely ground for chemical analysis. The oven dried plant material samples were wet digested by using concentrate of H2SO4/H2O2 (Lowther, 1980). Mineral elements N, P and K were determined in leaves and fruits using the method described by A.O.A.C. (1990), Chapman and Pratt (1978).

2.6.2. Leaf chlorophyll indication (SPAD)

For determination chlorophyll readings at harvest, greenness was done using a non- destructive method using a SPAD 502 chlorophyll meter for each plant, 3 recently full- expanded leaves were randomly chosen for SPAD (Soil Plant Analysis Development) measurement at the average of 3 readings was recorded (Yadava, 1985; Marquard and Tipton, 1987).

2.7. Statistical Analysis

Data were statistically analyzed using Costat Software (Steel and Torrie, 1980), and treatments means were compared using Duncan's Multiple Range test at 5% level of probability.

3. RESULTS AND DISCUSSION

The results of the soil analysis before cultivated (Table 1) showed that the soil used in the experiment was sandy loam texture. The amounts of available macro and micro-elements were in the range of low availability for plant nutrition as compared to standard values (Soltanpour, 1985). The amount of available phosphorus of the soil was below (35 mg/kg) from the range of availability according to Landon (1991). This finding further signifies that the soil requires external application of nutrients for high growth and yield of the crop. Data presented in table (2) indicated that there are different types of compost which is rich in macro elements in the suitable range of the require for the plants.

3.1. Vegetative growth characters

The results in Table (3) illustrated that all combinations of different compost types treatments when applied on watermelon significantly, increased all vegetative growth characters compared with non treated plants (Control treatment that was recommended doses of chemical fertilizer N, P and K) during both locations. Generally untreated plants showed the lowest significant average values for all vegetative growth characters. The recorded results indicated that the highest average values were taken place due to the application of Compost E (Chicken manure only) for each of vine length character as 564.23 and 548.67 cm; respectively and for number of leaves per plant character as 77.23 and 74.93 during both locations. Regarding number of branches per plant character, the combinations of Compost C and Compost E gave rise the highest average values during both locations as 4.67 for Compost C at two locations and (5.67and 5.33) for Compost E consecutively.

Table 3. Effect of combinations of differernt compost types on morphological characters of watermelon (cv. SkataF1 hyprid) for two locations at season 2018/2019.

	Vine length (cm)		No.Leaves/ Plant		No.branches/plant	
Treatments	**location 1**	**location 2**	**location 1**	**location 2**	**location 1**	**location 2**
T_1- Jojoba leaves Compost	**392.83 e**	**381.10 e**	**59.57 e**	**57.63 e**	**2.67 d**	**2.33 d**
T_2- Compost A	**435.00 d**	**421.80 d**	**62.73 d**	**60.60 d**	**3.67 c**	**3.67 bc**
T_3- Compost B	**481.43 c**	**466.90 c**	**69.67 c**	**67.57 c**	**3.67 c**	**3.33 cd**
T_4- Compost C	**534.63 b**	**517.20 b**	**73.37 b**	**71.13 b**	**4.67 b**	**4.67 ab**
T_5- Compost D	**354.90 f**	**344.30 f**	**56.60 f**	**54.93 f**	**2.00 d**	**2.33 d**
T_6- Compost E	**564.23 a**	**548.67 a**	**77.23 a**	**74.93 a**	**5.67 a**	**5.33 a**
T_7- Control (NPK)	**314.93 g**	**309.63 g**	**53.70 g**	**52.13 g**	**0.67 e**	**0.33 e**
L.S.D. 0.05	**6.939**	**5.787**	**0.151**	**0.256**	**0.726**	**1.075**

Values with the same alphabetical letters, within a comparable group of means , don't significant differ, using L.S.D test at 0.05 level.

The tabulated results indicated, clearly, their modes of action in regulating the physiological processes on growth and development of watermelon under the study via chicken manure application, according to Aliyu (2000), the increase in nitrogen as found in chicken manure has its effect on the vegetative improvement of crops and ensures healthy and vigorous growth. Khandaker *et al*., (2017) reported that application of organic matter improve the physiology and yield of okra.These are in harmony with (Shaheen *et al*., 2015) who reported that farmyard manure can be a slow release fertilizer. Also,compost C and B have effects on vegetative growth characters of watermelon which increases the productivity of the plants, furthermore plants that receives the combinations of different types of compost were superior with respect to higher yield because of promoting activity of benefit bacteria around the root rhizosphere which supplied the watermelon with nutrients and elements for growth and yield, these are in cccordance with Zhao *et al*., 2018 and Pereg *et al.*, 2016.

3.2. Yield characters

Results presented in Tables (4 and 5) expressed that fertilization with combinations of different compost types affected significantly all studied characteristics of the tested watermelon cultivar (i.e. number of fruits per plants after 60 days from sowing, number of fruits per plants at harvest, fruit weight, fruit length, fruit diameter, fruit yield per plant and per feddan). Whereas, the lowest significant average values for all yield characters of watermelon fruits were derived from control plants compare to fertilized plants with those combinations during both locations. Data presented in table (4) cleared that the highest average values for number of fruits per plants after 60 days from sowing character were obtained form the combined treatments Compost B, Compost C and Compost E as (2.67 and 2.33,) for Compost.B ,(3.00 and 3.33) for Compost.C and (3.67 and 3.33) for Compost E, brought about the highest average values for number of fruits per plants at harvest character with Compost E as 15.67 during the two locations. Regardes total yield per plant and total yield per feddan, plants treated with Compost E led to highest average values as (26.95 and 26.17; Kg) and (173.26 and 168.24; Kg) for each in turn respectively, followed by applied with Compost C for the above mentioned characters during both locations. One of the effective ways of increasing the yield on watermelon crops is boosting the nutrient status of the soil either with the use of organic matters such as farm yard and plant residues and the use of composting (Yang *et al.*, 2019). According to Assunta *et al.*, 2020 the use of organic manure enhances soil productivity, improves the soil organic carbon content, soil micro-organisms, improves soil physical structure, the nutrient status of the soil and enhances crop yield. Data also, was in agreement with other reserchers, they said that When basal farmyard manure was applied on poor sandy soil with 0.3 to 0.5 % humus content on Charleston Gray watermelon produces highest fruit yield 42.4 t ha-1 (Audi *et al.*, 2013).

3.3. Fruit quality's characters

3.3.1. Fruit weight, length and diameter

Results postulated in Table (5) revealed that all applied organic and bio combinations treatments showed highest significant average values of fruit weight, fruit length and fruit diameter characters compared to control plants. Plants that fertilized with Compost E followed by Compost C then Compost B led to the highest values of the given characters, such as (1.68 and 1.64; Kg) for fruit weight character and as (20.33 and 19.83) for fruit length character, also, as (17.13 and 17.03; cm) for fruit diameter at both locations compare to control treatment which gave the lowest mean values of the above mentioned characters. Having done the similar work on Organic manure has been reported by many researchers to give significant improvement in crop growth and yield.

Table 4. Effect of combinations of differernt compost types on yield and yield components of watermelon (cv. SkataF1 hyprid) for two locations at season 2018/2019.

	No. of fruits/plant after 60 days from sowing		No. of fruits/plant at harvest		Total yield (Kg/plant)		Total yield (Kg/fed)	
Treatments	**location 1**	**location 2**	**location 1**	**location2**	**location1**	**location2**	**location 1**	**location 2**
T_1- Jojoba leaves Compost	**1.33 c**	**1.67 bc**	**11.67 e**	**11.33 cd**	**16.46 e**	**15.97 e**	**105.79 e**	**102.66 e**
T_2- Compost A	**1.67 c**	**2.00 b**	**12.67 d**	**12.00 c**	**18.76 d**	**18.30 d**	**120.62 d**	**117.67 d**
T_3- Compost B	**2.67 b**	**2.33 ab**	**13.67 c**	**13.33 b**	**21.27 c**	**20.63 c**	**136.71 c**	**132.64 c**
T_4- Compost C	**3.00 ab**	**3.33 a**	**14.67 b**	**14.33 b**	**23.98 b**	**23.24 b**	**154.16 b**	**149.40 b**
T_5- Compost D	**1.00 cd**	**0.67 c**	**11.00 e**	**10.33 de**	**14.32 f**	**14.17 f**	**92.09 f**	**91.09 f**
T_6- Compost E	**3.67 a**	**3.33 a**	**15.67 a**	**15.67 a**	**26.95 a**	**26.17 a**	**173.26 a**	**168.24 a**
T_7- Control (NPK)	**0.33 d**	**0.67 c**	**9.33 f**	**9.33 e**	**11.89 g**	**11.66 g**	**76.40 g**	**75.00 g**
L.S.D. 0.05	**0.924**	**0.989**	**0.808**	**1.051**	**0.102**	**0.153**	**0.659**	**0.998**

Values with the same alphabetical letters, within a comparable group of means , don't significant differ, using L.S.D test at 0.05 level.

Table 5. Effect of combinations of differernt compost types on yield quality's characters of watermelon (cv. SkataF1 hyprid) for two locations at season 2018/2019.

	Average fruit weight (Kg)		Fruit length (cm)		Fruit diameter(cm)	
Treatments	**location 1**	**location 2**	**location 1**	**location 2**	**location 1**	**location2**
T_1- Jojoba leaves Compost	**1.37 e**	**1.34 e**	**15.80 e**	**15.93 c**	**12.03 e**	**12.17 e**
T_2- Compost A	**1.44 d**	**1.40 d**	**16.90 d**	**16.63 c**	**13.50 d**	**13.20 d**
T_3- Compost B	**1.52 c**	**1.48 c**	**17.93 c**	**17.73 b**	**14.83 c**	**14.37 c**
T_4- Compost C	**1.60 b**	**1.55 b**	**18.87 b**	**18.50 b**	**15.97 b**	**15.90 b**
T_5- Compost D	**1.30 f**	**1.26 f**	**15.07 f**	**14.60 d**	**11.00 f**	**11.17 f**
T_6- Compost E	**1.68 a**	**1.64 a**	**20.33 a**	**19.83 a**	**17.13 a**	**17.03 a**
T_7- Control (NPK)	**1.19 g**	**1.15 g**	**13.33 g**	**13.67 e**	**9.93 g**	**9.93 g**
L.S.D. 0.05	**0.003**	**0.013**	**0.670**	**0.769**	**0.479**	**0.494**

Values with the same alphabetical letter (s), within a comparable group of means , don't significant differ, using L.S.D test at 0.05 level.

Organic manure is a reservoir of nutrients and these nutrients are released during mineralization and humification, thus supplying the necessary elements for plant growth (Eifediyi *and* Remison 2010), they stated that the application of organic manure has been observed to consistently increase the yields of horticultural crops such as eggplant (*Solanum melongena*), pepper (*Capsicum annum L.*) and tomatoes (*Lycopersicon esculentus*). Furthermore, using PGPR microorganisms inoculants in this study showed that, these introduced bacteria must compete with the often better-adapted native microflora and mostly cannot withstand predation by soil microfauna. As a response, a major role of any formulation is to provide a more suitable microenvironment, combined with physical protection for a prolonged time. Formulations employed in the field should be designed to provide a reliable source of bacteria that can survive in the rhizosphere and become available to crops when needed (Calvo *et al.,* 2014; Vassilev *et al.*, 2015), these are in agreement with those (Herrmann and Lesueur 2013; Bashan *et al.*, 2014).

3.4. Plant chemical analysis

3.4.1. Leaf chlorophyll reading (SPAD)

Data presented in Table (6) divulged that higest reading values of chlorophyll index were found when plants fertilized with Compost A followed by Compost B, Compost C,Compost E and jojoba leaves compost during both locations. This event may be occurred owing to the ability of chicken manure as a good source of N for sustainable crop production and/ or to regulate the leaf photosynthetic functions as in case of watermelon readings in this study, these are in harmony with other researchers who reported that all organic fertilization with chicken manure strategies resulted in, high NH_4^+ to NO_3^- ratios, and nutrient balances in the root zone and therefore enhance Photosynthesis because of function of material fertilized in increase photosynthetic rate in parsley leaves reported by (Pokhrel *et al*., 2017). This also, might be due to efficient absorption and assimilation of nitrogen from the manure by the plant which serves as a constituent of chlorophyll which has been reported to be directly proportional to photosynthetic

Table 6. Effect of combinations of differernt compost types on Chlorophyll index and leaves nutrient contents of watermelon (cv. SkataF1 hyprid) for two locations at season 2018/2019.

	Chlorophyll index reading by SPAD		N (% DW) in leaves		P (% DW) in leaves		K (% DW) in leaves	
Treatments	**location1**	**location2**	**location1**	**location2**	**location1**	**location2**	**location1**	**location2**
T_1- Jojoba leaves Compost	**33.73 b**	**34.93 abc**	**0.60 d**	**0.63 d**	**0.37 d**	**0.40 d**	**4.47 f**	**4.97 d**
T_2- Compost A	**36.43 a**	**36.57 a**	**0.63 d**	**0.70 d**	**0.53 cd**	**0.50 cd**	**3.20 g**	**2.73 e**
T_3- Compost B	**36.87 a**	**35.70 ab**	**0.87 c**	**0.90 c**	**0.47 d**	**0.53 bcd**	**8.60 b**	**9.37 b**
T_4- Compost C	**37.83 a**	**34.80 abc**	**1.07 c**	**1.07 bc**	**0.80 abc**	**0.70 abc**	**9.57 a**	**10.60 a**
T_5- Compost D	**31.67 b**	**33.00 bc**	**1.30 b**	**1.20 b**	**0.87 ab**	**0.73 ab**	**7.77 c**	**8.97 b**
T_6- Compost E	**38.30 a**	**37.13 a**	**1.90 a**	**1.80 a**	**1.03 a**	**0.90 a**	**6.80 d**	**6.30 c**
T_7- Control (NPK)	**32.90 b**	**32.60 c**	**1.40 b**	**1.17 b**	**0.60 bcd**	**0.33 d**	**5.60 e**	**5.43 d**
L.S.D. 0.05	**2.197**	**2.561**	**0.217**	**0.195**	**0.258**	**0.213**	**0.253**	**0.782**

Values with the same alphabetical letter (s), within a comparable group of means , don't significant differ, using L.S.D test at 0.05 level.

potential and yield of any given plant (Biljana and Aca, 2009). These results are consistent with those reported by Ondieki *et al.,* (2011) who found an increase in Chlorophyll 'a' and 'b' with increase in the levels of manure on African nightshade species .Moreover, Jojoba leaves compost was very rich in nutrients and produced healthy vines which helped in building the soil structure, adds micronutrients and aids in water retention, that improve the growth and productivity of crops and enhance soil fertility(Assunta *et al.,* 2020), these finding was in agreement with those (Benzioni 2006 ; CJP, 2007) , they found that jojoba plant combat and prevent desertification in the Thar desert in India and Negev desert in Israel. So it became very effective for organic farming and climate smart agriculture. About microorganisms formula (PGPR) which enhanced the productivity of watermelon in this study several reviews summarized the field of plant inoculation. Most concentrated on specific genera, such as *Rhizobium* and *Azospirillum* , field performance of several PGPB (Plant Growth Promoting Bacteria), availability of various PGPBs and their modes of action (Herridge 2007 ; Bashan and de-Bashan 2015 ; Pereg *et al.*, 2016), they said that "bacterial isolates" refer to specific bacterial strain of PGPB/PGPR that can promote plant growth after inoculation.

3.5. Chemical analysis of leaves and fruits characters

3.5.1. Leaves and fruits N,P and K contents

Data outlined in Table (6) manifested that the highest percentages of leaves N concentrations were obtained when plants fertilized with Compost E as 1.90 and 1.80 % during both locations progressively. With regard to leaves P content during the two locations, nonsignificant effects were found among Compost C, Compost D and Compost E. The highest percent values of leaves K content in leaves were obtained from plant treated with the combination of Compost C during both locations as 9.57 and 10.60 % in succession. Meanwhile, jojoba leaves compost recorded the lowest percentage values of N,P and K content in leaves at two locations.

Data postulated in Table (7) illustrated that the highest percentage values of each of N,P and K fruits contents were (2.90 and 3.37 %) for first one and (1.03 and 1.20 %) for second one and (16.20 and 16.90 %) for third one, respectively were recorded from plants fertilized with Compost E followed by plants treated with Compost D and Compost C. These findings may be due to the production of organic acids during the degradation of organic fertilizers as well have a contribution in decreasing soil pH leading to increase in available amounts of elements in the rizosphere zone. Several investigators reported about the positive effect of applying organic fertilizer on the soil (El Etr *et al*., 2004). They ascribed to the mineralization of N from compost during its composition and might be the biological fixation of atmospheric N and its reflection on soil fertility. Increasing P soil content due to the application of organic fertilizers might be a result of its decomposition and producing organic acids, which increases the nutrients availability in the soil (Ahmed and Osman, 2003; Ahmed and Ali, 2005). Increasing K soil content due to the application of the combinations of compost types contained microorganism which changes the microbial community composition and abundance of manure and compost which promote plant growth in watermelon.This may be owing to the control of the rhizosphere microbial community composition through enrichment of bacterial diversity and depletion of fungal diversity, reduction of pathogen abundance, and stimulation of potentially beneficial taxa such as Bacillus, Lysobacter, and Pseudomonas. Similar results have been reported for watermelon (Ling *et al*., 2014) and cucumber (Yang *et al*., 2017).Thus, this strategy that changes the microbial community composition of the plant rhizosphere has good potential in providing essential elements and improving plant growth (Zhao et al., 2018).

Table 7. Effect of combinations of differernt compost types on fruits nutrient contents of watermelon (cv. SkataF1 hyprid) for two locations at season 2018/2019.

	N (% DW) in fruits		P (% DW) in fruits		K (% DW) in fruits	
Treatments	**location 1**	**location2**	**location1**	**location 2**	**location 1**	**location 2**
T_1- Jojoba leaves Compost	**0.73 e**	**0.80 e**	**0.40 d**	**0.50 e**	**8.60 e**	**9.20 e**
T_2- Compost A	**0.90 e**	**1.13 d**	**0.50 cd**	**0.57 de**	**10.80 d**	**11.50 d**
T_3- Compost B	**1.23 d**	**1.40 cd**	**0.80 b**	**0.90 b**	**13.00 c**	**14.47 bc**
T_4- Compost C	**1.53 c**	**1.63 bc**	**0.63 bc**	**0.70 cd**	**14.83 b**	**15.17 b**
T_5- Compost D	**1.77 b**	**1.87 b**	**0.80 b**	**0.83 bc**	**12.57 c**	**13.77 c**
T_6- Compost E	**2.90 a**	**3.37 a**	**1.03 a**	**1.20 a**	**16.20 a**	**16.90 a**
T_7- Control (NPK)	**0.90 e**	**1.23 d**	**0.60 c**	**0.77 bc**	**14.40 b**	**14.23 bc**
L.S.D. 0.05	**0.207**	**0.255**	**0.174**	**0.162**	**0.899**	**1.043**

Values with the same alphabetical letter (s), within a comparable group of means , don't significant differ, using L.S.D test at 0.05 level.

These are in accordance with (Francisco *et al*., 2019) who stated that organic fertilizer increase mineral contents in vegetative and fruit part in watermelon.

4. Conclusion:

The use of different types of compost improved the performance of watermelon when compared with control treatment. All growth and yield parameters measured were positively improved by different combinations of compost application which supported by (Assunta *et al.,* 2020 ; Dube *et al.*,2020) that adequate nutrient available for growing plants improves crop growth and yield parameters. Also, the main effect of the combinations under investigations as organo-fertilizers were significant on all the parameters considered and for the most of the traits best values were obtained with the combine application of Compost E followed by Compost A, Compost B, Compost C, Compost D and jojoba leaves compost. Hence application of Compost E is the optimal treatment for the production of watermelon in the study area.

5. Future prospective

Environmentalists worldwide are pressing the market and society for a switch over to organic farming and biofertilizers. Organic farming aims to be a more environmentally sustainable form of agricultural production, combining best environmental practices, and emphasizing biodiversity protection and the preservation of natural resources. Organic farming is one such strategy that not only ensures food safety, but also adds to the biodiversity of soil. Organic farming is the raising of unpolluted crops through the use of manures, biofertilizers that provide optimum nutrients to crop plants, keeping pests and pathogens under control.

6. REFERENCES

AOAC (1990). Official methods of analysis. Association of official analytical chemists. 15th ed. Washington D.C., USA.

Ahmed MMM, Osman EBA (2003). Response of peanut plants grown a sandy calcareous soil to fertilization with farmyard manure and organo-mineral fertilizer prepared from some sugar cane wastes. Assiut. J. Agric. Sci., Vol.34 (6): 337-347.

Ahmed MMM, Ali EA (2005). Effect of different sources of organic fertilizers on the accumulation and movement of NPK in sandy calcareous soils and the productivity of wheat and grain sorghum. Assiut. J.Agric. Sci., Vol.36 (3): 147-159.

Aliyu L (2000). The effects of organic and mineral fertilizer on the growth, yield and composition of pepper (*Capsicum annum L*). Biological Agriculture and Horticulture 18:29-36.

Al-Obaidi JR, Halabi MF, AlKhalifah NS, Asanar S, Al-Soqeer AA, Attia MF (2017). A review on plant importance, biotechnological aspects, and cultivation challenges of jojoba plant. Biological research, 50(1):25.

Anonymous (2019). FAO statistics. Food and Agriculture Organization of the United Nations, Rome, Italy.

Assunta MP, Persiani A, D'Adamo C, Pergola M, Pastore V, Sileo R, Ippolito G, Lombardi MA, Celano G (2020). Composting as Manure Disposal Strategy in Small/Medium-Diameter Livestock Farms: Some Demonstrations with Operative Indications. Sustainability, 12, 3315.

Audi W, Aguyoh JN, Gao-Qiong L (2013). Yield and quality of watermelon as affected by organic and inorganic nitrogen sources. Asian Journal of Agriculture and Food Science, 1:180–185.

Bashan YLE, de-Bashan (2015). Inoculants for Azospirillum. In: Cassán FD, Okon Y, Creus CM (eds) Handbook for Azospirillum. Technical issues

and protocols. Springer International Publishing, Cham, pp 469–485.

Bashan Y, de-Bashan LE, Prabhu SR, Hernandez JP (2014). Advances in plant growth-promoting bacterial inoculant technology: formulations and practical perspectives (1998–2013). Plant Soil 378:1–33.

Benzioni A (2006). Jojoba research as a basis for domestication of jojoba in Israel. Israel. Journal of Plant Sciences 54(3): 157-167.

Biljana B, Aca M (2009). Correlation between Nitrogen and Chlorophyll Content in Wheat (*Triticum aestivum L.).* Kragujevac Journal of Science 31:69-74.

Calvo P, Nelson L, Kloepper JW (2014). Agricultural uses of plant biostimulants. Plant Soil, 83:3–41.

Ceglie FG, Amodio ML, Colelli G (2016). Effect of organic production systems on quality and postharvest performance of horticultural produce. Horticulturae 2(4):7.

Chapman HD, Pratt PF (1978). Methods of analysis for soils. Plant and water Univ. California. Div. Agric. Sci., 16-38.

CJP (2007). Centre for Jatropha Promotion and Biodiesel. Jojoba: A Potential Tree-Borne Oil Seed. [http://www.jatrophabiodiesel.org/Jojoba/index.php] site visited on 11/7/ 2011.

Cook RJ (1993). Making greater use of microbial inoculants in agriculture. Ann Rev Phytopathol, 31:53–80.

Dube J, Ddamulirab G, Maphosaa M (2020). Watermelon production in Africa: challenges and opportunities. International Journal of Vegetable Science, DOI: 10.1080/19315260. 1716128.

Eifediyi EK, Remison SU (2010). Growth and yield of cucumber (*Cucumis sativus L*.) as influenced by farmyard manure and inorganic fertilizer. Journal of Plant Breeding and Crop Science Vol. 2(7), pp. 216-220.

El-Etr Wafaa, T, Laila KM, El- Khatib EI (2004). Comparative effects of bio-compost and compost on growth, yield and nutrients content of pea and wheat plants grown on sandy soils. Egypt. J. Agric. Res., 82 (2):73-94.

Emmanuel M, Maerere AP (2018). Growth and yield performance of watermelon during dry and wet seasons under tropical conditions. International Journal of Vegetable Science, DOI: 10.1080/19315260. 1439554.

Francisco SOF, Pereira FHF, Brito MEB, Medeiros JE, Lacerda FHD Júnior JEC (2019). Yield, quality and nutrient accumulation in watermelon as a function of organo-mineral fertilization. Comunicata Scientiae 10(1): 141-149.

Herridge DF (2007). Inoculation technology for legumes. In: Dilworth MJ, James EK, Sprent JI, Newton WE (eds) Nitrogen-fi xing leguminous symbioses, vol 7. Springer, Dordrecht, pp 77–115.

Herrmann L, Lesueur D (2013). Challenges of formulation and quality of biofertilizers for successful inoculation. Appl Microbiol Biotechnol 97:8859–8873.

Ingham ER (2000). Brewing compost tea. Kitchen Gard 29:16–19.

Khandaker MM, Jusoh N, Ralmi NH, Ismail SZ (2017). The effect of different types of organic fertilizers on growth and yield of *Abelmoschus esculentus L. Moench* (okra). Bulgarian Journal of Agriculture Science, 23 (1): 119–125.

Landon JR (1991). Booker tropical soil manual: A handbook for soil survey and agricultural and evaluation in the tropics and sub-tropics. Longman Scientific and Technical, Essex, New York. p. 474.

Ling N, Deng K, Song Y, Wu Y, Zhao J, Raza W (2014). Variation of rhizosphere bacterial community in watermelon continuous mono-cropping soil by long-term application of a novel bio-
organicfertilizer.Micro.biol.Res.169:(7±8):570±8. ttps://doi.org/10.1016/j.micres.2013.10.004 PMID: 24263158.

Lowther JR (1980). Use of single H2SO4- H2O2 disgest for the analysis of Pinus radiata, needles. Commun. Soil Sci. Plant Anal., 11: 175-188.

Marquard RD, Tipton JL (1987). Relationship between extractable chlorophyll and an in situ method to estimate leaf greenness. Hort.Science, 22 (6).

Maundu P, Achigan-Dako E, Morimoto Y (2009). Biodiversity of African vegetables In: Shackleton, C.M., Pasquini, M.W. and Drescher, A.W. (eds.), African indigenous vegetables in urban agriculture, Earthscan, London, pp 64-104.

Ondieki MJ, Aguyoh JN, Opiyo AM (2011). Fortified compost manure improves yield and growth of African nightshades. I.J.E.M.S., 2(2):231-237.

Page AL, Miller RH, Keeney DR (1982). Methods of Soil Analysis. Part 2 - Chemical and Microbiological Properties, 2nd Edition. Agronomy Society of America. Madison, WI.

Pereg L, de-Bashan LE, Bashan Y (2016). Assessment of affinity and specificity of Azospirillum for plants. Plant Soil 399(1–2):389–414.

Pokhrel B, Sorensen JN, Kristensen HL, Petersen KK (2017). Nutrient availability, photosynthesis, and growth of parsley fertigated with chicken manure extract and lupin sap. Can. J. Plant Sci. 97: 1004–1013.

Shaheen AM, El-samad EHA, Rizk FA, El-al FSA (2015). Response of growth, yield and fruit quality of cantaloupe plants (*Cucumis melo L*.) to

organic and mineral fertilization. Middle East Journal of Applied Sciences 5(1): 76–82.

Soltanpour PN (1985). Use of ammonium bicarbonate DTPA soil tests to evaluate elemental availability and toxicity. Commun. Sci. Plant. Analysis, 323-338.

Steel RGD, Torrie JH (1980). Principles and Procedures of Statistics. 2nd addition. MC. Grow. Hill, New York.

Vassilev N, Vassileva M, Lopez A, Martos V, Reyes A, Maksimovic I, Eichler-Löbermann B, Malusà E (2015). Unexploited potential of some biotechnological techniques for biofertilizer production and formulation. Appl Microbiol Biotechnol 99:4983–4996.

Yadava UL (1985). Arapid and nondestructive methods to determine chlorophyll intact leaves. Hort.Science,21:1449- 1450.

Yang W, Yan H, Zhang J, Meng Y, Wang X, Ji L (2017). Response of rhizosphere microbial diversity and soil physico-chemical properties in a rotation of cucumber with Volvariella volvacea.Biocontrol.Sci.Technol.27(3):311±23. https://doi.org/10.1080/09583157.2016.1252313

Yang X, Liu E, Zhu X, Wang H, Liu H, Liu X, Dong W (2019). Impact of Composting Methods on Nitrogen Retention and Losses during Dairy Manure Composting. Int. J. Environ. Res. Public Health, 16, 3324.

Zhao J, Liu J, Liang H, Huang J, Chen Z, Y. Nie Y, Wang C, Wang Y (2018/2019/2019). Manipulation of the rhizosphere microbial community through application of a new bio-organic fertilizer improves watermelon quality and health. PLoS ONE 13(2): e 0192967. https:// doi.org/10.1371/journal.pone.0192967.

الملخص العربى

أستجابة البطيخ للمخلفات النباتية ومخلفات المطبخ وكمبوست سبلة الدواجن مع مخلوط البكتريا المنشطة لنمو الجذور والنمو النباتى كأسمدة عضوية حيوية

منى محمد يسرى جابر وأمال كرم أبو الجود

أجريت تجربة حقلية في كلية الزراعة، (سابا باشا) جامعة الإسكندرية خلال موسم النموالصيفى ٢٠١٨/٢٠١٩ في موقعين مختلفين. وكان الهدف الأساسى من الدراسة هو دراسة فعالية تأثيرتوليفات مختلفة من الكمبوست على جودة النمو والمحصول في البطيخ صنف(سكاتا هجين) . تم استخدام تصميم القطاعات العشوائية الكاملة بإستخدام ثلاث مكررات ، تم تنفيذ ٧ توليفات مختلفة هي : ١- كمبوست أوراق الجوجوبا بمعدل ٦ طن للفدان ، ٢- كمبوست أ (١٠٠%المخلفات النباتية + مخلفات المطبخ) بمعدل ٧ طن للفدان ، ٣- كمبوست ب (١٠٠% مخلفات نباتية ومخلفات المطبخ + البكتريا المنشطة للنمو الجذور والنمو النباتى) بمعدل ٦ طن للفدان ، ٤- كمبوست ج (٥٠% مخلفات نباتية ومخلفات المطبخ + ٥٠% سماد سبلة الدواجن) بمعدل ٦ طن للفدان ، ٥- كمبوست د (١٠٠% كمبوست ج + البكتيريا المنشطة لنمو الجذور والنمو النباتى) بمعدل ٦ طن للفدان ، ٦- كمبوست هـ (١٠٠% سماد سبلة الدواجن) بمعدل ٤ طن للفدان ، ٧- معاملة المشاهدة وهى الكميات الموصى بها من الأسمدة الكيمائية في البطيخ . تم تحديد أثار المعاملات على النمو والمحصول ومكوناته وجودة الثمار و المغذيات في أوراق وثمارالبطيخ. أحدثت التوليفات المختلفة من المعاملات العضوية إلى زيادة كبيرة في جميع الصفات المورفولوجية مثل طول النبات سم ، عدد الأوراق لكل نبات ، عدد الأفرع بكل نبات ، كما أحدثت زيادة كبيرة في صفات المحصول وهى عدد الثمار و وزن الثمار وطول الثمرة وقطر الثمرة بالإضافة إلى تحسين مستوى العناصر في الأوراق والثمار وبالتالي تحسين المحصول الكلى. يظهر من خلال هذا العمل أن المعاملة السادسة (سماد سبلة الدواجن) أعطت أعلى القيم المتحصل عليها في معظم الصفات المدروسة ويفسر ذلك المحتوى العالى من النيتروجين في هذا السماد الذى ساعد على زيادة النمو الخضرى وبالتالي الزيادة في المحصول الناتج في البطيخ بالمقارنة بمعاملة المشاهدة . أدى كمبوست أوراق الجوجوبا للحصول على أعلى النتائج المتحصل عليها في صفة محتوى الأوراق من الكلورفيل بالإضافة إلى توليفات كمبوست أ،ب،ج،د كان لهم تأثير إيجابى على صفة محتوى الأوراق من الكلورفيل و على المحصول الكلى ومحتوى الأوراق والثمار من العناصر الغذائية، في حين أن معاملة المشاهدة كانت بإستمرار تعطى أقل النتائج المتحصل عليها في معظم الصفات المدروسة وعلى ذلك فإن المزارع يستطيع أن يعظم من إنتاجه بإستخدام المعاملات العضوية السابق ذكرها في هذه الدراسة والتي تحافظ على التربة و البيئة من التلوث بالأسمدة الكيميائية وتحافظ على التوازن الحيوى للتربة.