Available online free at www.futurejournals.org

The Future Journal of Biology

Print ISSN: 2572-3006 Online ISSN: 2572-3111

Future Science Association

Future J. Biol., 2 (2022) **26-33** **OPEN ACCES**

DOI: 10.37229/fsa.fjb.2022.04.16

ATTEMPTS TO IMPROVE GROWTH AND PRODUCTIVITY OF SUCCKARY MANGO TREES BY USING PIGEON MANURE TEA AND *Spirulina plantensis* ALGA

Ali, H. Ali; Hamdy. I.M. Ibrahim*; Ahmed M. Akl and Mahmoud H.G. Madani

Hort. Dept, Fac. of Agric., Minia University, **Egypt**.

***Corresponding author:** hamdy_france@yahoo.com **Received:** 16 Feb. 2022 **; Accepted:** 16 April 2022

ABSTRACT: A field experiment was carried out during two successive seasons 2017/2018 and 201/2019 with the object of improving the vegetative growth and fruiting of 15-years old Succkary mango trees grown in private orchard located at Edfu district, Aswan Governorate-Egypt. Partial replacement of mineral nitrogen fertilization by using pigeon manure tea and *Spirulina plantensis* fungi were examined. Higher and significant vegetative growth (in terms of shoot lengths, number of shoots/tree, number of leaves/shoot and leaf area) were associated with reduced the mineral N doses by using pigeon manure tea and *Spirulina plantensis*. However, Increasing the nitrogen replaced ratio over 60% (using 30% pigeon manure tea + 30% *Spirulina plantensis*) resulted a significant reduced in all vegetative growth parameterizes. Succkary mango Productivity (yield "kg/tree", fruit number/tree and fruit weight "g") significantly enhanced as a result of increasing the ratio of mineral N replaced by pigeon manure tea + *Spirulina plantensis*. On the opposite side, increasing the ratio of mineral N replacement over than 40% (using 20% pigeon manure tea + 20% *Spirulina plantensis*) caused a significant decrease in yield (kg)/tree and its components. Then, the present investigation recommended by recommended to replace 40% of mineral N by using 20% pigeon manure tea + 20% *Spirulina plantensis* in order to improve vegetative growth parameters, and trees productivity.

Key words: *Mangifera indica*, Succkary mango, pigeon manure tea + 10% *Spirulina plantensis.*

INTRODUCTION

Mango tree (*Mangifera indica*) belongs to family Anacardaceae. Mangos are common and main fruit in many countries such as; India, Pakistan, Philippines and Bangladesh and Egypt. Mango is considered as one of the most important commercial and favorite fruits in Egypt. In Aswan Governorate where the investigation took place, mango ranks the fourth position after Ismailia, Noubaria, and Sharkia, since fruiting area in this region reached 9568 feddans produced 48203 tons (**Annual Reports of Statist. & Agric, 2018**). Succkary mango *cv*. is considered a prime and outstanding mango cultivar, and has strong spicy flavor, producing appealing aroma, sweet, low in fiber, regular bearing and middle season maturity, popular in the domestic market for fresh consumption and has a wide acceptance in international markets (**Madany, 2017**). However, under Aswan Governorate the trees predictability is remarkably lower than other countries (**Madany, 2017)**.

Using organic and biofertilizer extracts nowadays for fruit crops has called the attention of research workers as an alternative to synthetic auxins and mineral nitrogen fertilization. They are safe for human, animal and environment. Clean cultivation is greatly achieved by using organic and biofertilizers (**Russo and Berlyn, 1990**; **Kulk 1995; Litterick *et al.*, 2004; Eman *et al.*, 2010; Ibrahim *et al.*, 2015 and Ibrahim *et al.*, 2019**). The water extract of pigeon manure termed pigeon manure tea, it retains all the beneficial soluble bioactive compounds, making it a potent source of plant stimulatory and defensive compounds. The exact nature and extent of these features are, however, modified by fermentation process, feedstock quality. Furthermore, the beneficial effects of the biofertilizer, such *Spirulina plantensis*, are attributed to their own from natural hormones, glutathione, lecithin, adenylic acid, enzymes and co- enzymes, vitamins B1 & B6 and glycine. Also, they are essential for the synthesis of protoporphyrin, precursor of plant pigments and photosynthesis through enhancing the release of CO_2

(**El-Shenawy and Fayed, 2005; Abd El-Aal *et al.*, 2007; Chang *et al.*, 2007; Gad-El-Kareem, 2009; Ibrahim *et al.*, 2009** and **De-Oliveira *et al.*, 2020)**

The target of this study was examining the partially replacement of mineral nitrogen by using pigeon manure tea and *Spirulina Plantensis* alga on growth, fruit setting%, yield (kg/tree), number of fruits/tree and fruit weight (g) of Succkary mango trees grown under Aswan Governorate conditions, Egypt.

MATERIALS AND METHODS

This field experiment was conducted during two seasons 2017/2018 and 2018/2019 on 24 uniform in vigor 15-years old Succkary Mango trees grown in private orchard located at Edfu district, Aswan Governorate – Egypt), where the soil texture is loamy clay and well drained water. The chosen trees are planted at 7 X 7 meters apart. Surface irrigation system using Nile water was adopted. The trees are subjected to regular horticulture practices that were commonly applied in the orchard including fertilization, irrigation, hoeing and pest management.

Soil characters

The orchard where the present experiment carried out was loamy clay soil (Table 1). Whereas, a composite sample was collected and subjected to Physical and chemical analysis using to the procedures outlined by and **Wilde *et al.*, (1985**) and **Uurman *et al.* (1996)**, the data are shown in Table (1).

Table 1. Physical and chemical analysis of experimental orchard soil

Constituents	Values
Sand %	6.1%
Silt %	86.7%
Clay %	7.2%
Texture	loamy clay
EC (1 : 1 extract, dSm^{-1})	0.59
Organic matter %	2.39
pH (1 : 2.5 extract)	7.4
Soluble cations (meq/l)	
Ca^{++}	1.5
Mg^{++}	2.5
Na^{+}	0.69
K+	0.74
Soluble anions (meq/l)	
HCO_3	1.1
Cl^{-}	1.7
Available P (Olsen, ppm)	6.14

Experimental work

In order to study the effect of partial replacement of mineral N fertilization on growth and fruiting of Succkary mango trees, by using pigeon manure tea and *Spirulina plantensis* on Succkary mango trees using complete randomized block design (CRBD) arrangement, the following six doses of partial replacement were examined:

1- 100% mineral + 0.0% organic + 0.0% bio fertilization

2- 80% mineral N + 10% pigeon manure tea + 10% Spirulina plantensis.

3- 60% mineral N + 20% pigeon manure tea + 20% Spirulina plantensis.

4- 40% mineral N + 30% pigeon manure tea + 30% Spirulina plantensis.

5- 20% mineral N + 40% pigeon manure tea + 40% Spirulina plantensis.

6- 0.0% mineral N + 50% pigeon manure tea + 50% Spirulina plantensis.

Each treatment was replicated four times, one tree per each. The obtained data were analyzed and the differences between the means were compared by using LSD at 5% according to **Snedecor and Cochran (1980).**

Preparation of pigeon manure tea

Fresh pigeon manure was obtained from three pigeonhole near the farm. The manure was placed in burlap bags (2 kg/bag), then the bags was placed in plastic drums filled with water (20 liters/drum), a rock was added to the manure to make sure it did not float. Then the barrels were covered with plastic wrap to complete the fermentation process. The burlap bags were manual moved up and down several times daily. After three weeks of fermentation, the pigeon manure tea was ready for use. The following Table shows the chemical composition of the pigeon manure tea used in the experiment (**Price and Duddles, 1984)**.

Table 2. Chemical composition of pigeon manure tea (1:10 extraction) used in this experiment

Constituents	Values
pH	7.92
EC (dS.m^{-1})	1.46
Total N (ppm)	219
Phosphorus (ppm)	329
Potassium (ppm)	318
Fe (ppm)	7.52
Cu (ppm)	3.1
Zn (ppm)	1.78
Mn (ppm)	0.05

Preparation of *Spirulina plantensis* alga

Spirulina plantensis alga was grown on Potato dextrose media (according to **EL-Boray *et al.*, 2015**) incubated for 2-3 days at 28 C° to maintain populations of 3 x 10^8 colony forming unit ml^{-1} (CFU\ml). The fungi strain was kindly provided from Dept. of Microbiology Faculty of Agriculture, Minia University, Egypt.

Measurement of vegetative growth

During the maturation stage at the middle of July for both seasons, the following vegetative characteristics were measured: Shoot lengths in cm, Number of leaves per shoot, Number of new shoots/tree Leaf area (cm^2) were determined, according to **(**According to **Ahmed and Morsy, 1999**) **using** the following equation:

Leaf area = 0.67 (L x W) + 107.15

whereas L= leaf length (cm) and W = leaf width (cm)

Determination of leaves main pigments

Samples of five mature and fresh leaves from those collected for mineral determination cut into small pieces and 0.05 g weight from each sample was taken, homogenized and extracted by 25% acetone in the presence of little amounts of Na_2CO_3 then filtered. The extract was completed to a known volume (20 ml) with acetone 85%. The optical density of the filtrate was determined at the wave length of 662 and 664 nm to determine chlorophylls A and B, respectively. Concentration of each pigment was calculated by using the following equations according to **Ward and Johnston (1962).**

Chlorophyll A = (9.784 x E 662) – (0.99 x E 644) = mg / 100 g FW

Chlorophyll B = (21.426 x E 644) – (4.65 x E 622) = mg /100 g FW

Total carotenoids = (4.965 x E 4460 - 0.268 (chlorophylls a + b)

where E = optical density at a given wavelength.

Yield and its components

During the two experimental seasons, the total number of fruits per tree were counted at fruit harvested at second week of Jun), 12 fruit were randomly collected, in order of 3 fruit per each said of tree, then the weight of each fruit was recorded in grams, so the main fruit weight (grams) was calculated. The yield (kg)/tree calculated mathematically, as a result of multiplying the average fruit weight by the number of fruits/tree.

RESULTS AND DISCUSSION

Effect on vegetative growth of Succkary mango trees

The obtained data illustrated in Table (3) shows that, the shoot lengths (cm), shoot diameter (cm) and number of leaves/shoot were remarkable increased due to replacement mineral N fertilization by using pigeon manure tea (as an organic fertilizer) and *Spirulina plantensis* (as a bio-fertilizer) during the two experimental seasons. This increment reached a maximum when replaced 60% of mineral N by using 30% pigeon manure tea and 30% *Spirulina plantensis* in comparison with control. It is clear from the obtained data that, replacement of mineral N partially by using pigeon manure tea and *Spirulina plantensis* effectively enhancing shoot lengths (cm), shoot diameter (cm) and number of leaves / shoot significantly, these increment continually until using 60% nitrogen fertilization in form of organic and biofertilizers. Then, increasing the replacement ratio than 60% caused a significant decreased in all vegetative growth parameters.

The trees received 40% mineral N + 30% pigeon manure tea + 30% Spirulina plantensis present the highest shoot length (cm), shoot diameter (cm) and number of leaves/shoot. Contrary, the lowest shoot length (cm), shoot diameter (cm) and lowest number of leaves / shoot were obtained from the trees received 0.0% mineral N + 50% organic N + 50% bio-fertilizer, during the two experimental seasons respectively. Furthermore, leaf area was also significantly affected by the partial replacement of mineral N using pigeon manure tea and *Spirulina plantensis.* However, increasing the ratio of mineral N replacement than 60% significantly decreased the leaf area (cm^2), during the two experimental seasons.

The obtained results concerning the stimulation the vegetative growth of Succkary mango trees as a result of partial replacement of mineral N by using organic manure tea and *Spirulina plantensi*s are in harmony with those obtained by **El-Khawaga (2011**) on organic and biofertilization of Florida prince peach trees; **Mohamed (2014)** on the response of Le-Conte Pori trees **to** tea compost treatments; **Ibrahim *et al.* (2015)** on organic and biofertilization of Keitte mango trees; **Haggag *et al.*, 2014** on Agizzi olive trees; **Baiea and El-Gioushy (2015)** on Grande Naine plant; **Mostafa *et al.* (2009)** on Washington Navel orange; **Sau *et al.* (2017)** on Himsagar Mango trees **Hagag *et al.*, 2018 on olive trees** and **Abd El-Hamid and El-Shazly (2019)** on Succkary mango trees grown in sandy soil.

The previous positive concerning the action of organic manure namely pigeon manure tea and bio-fertilization with *Spirulina plantensis* algae on vegetative growth of Succkary mango trees was attributed mainly to the beneficial effects of these fertilizers in reducing soil salinity, soil pH and soil

erosion and enhancing the production of natural hormones namely IAA, GA_3 and cytokines, increasing mineral nutrients availability and soil microbial activity (**El-Kramany *et al.*, 2000; Litterick *et al.*,2004 ; Mohammed *et al.*, 2010; Von-Bennewitz and Hlusek, 2006; Hasan, 2015 and Hagag *et al.*, 2018).**

Leaf pigments content

Data illustrated in table (4) showed the effect of partial replacement of mineral nitrogen fertilizers using pigeon manure tea as organic fertilizer and *Spirulina plantensis* algae as biofertilizer on leaves main pigments contents (chlorophyll a, chlorophyll b, total chlorophylls and total carotenoids). The obtained data showed that increasing the replacement ratio of pigeon manure tea + *Spirulina plantensis* ratio from 0 to 60% was capable to enhancing all the main pigments significantly in the leaves of Succkary mango trees, during the two experimental seasons. On the opposite side, increasing the replaced ratio of pigeon manure tea + *Spirulina plantensis* than 60% caused a significant decrease in all the main pigments these data was true during the two experimental seasons

.

Table 3. Effect of replacing mineral nitrogen partially by using pigeon manure tea and *Spirulina plantensis* on vegetative growth of Succkary mango trees, during 2018 and 2019 seasons

Treatments	Shoot lengths (cm)		Shoot thickness (cm)		No. of leaves /shoot		Leaf area (cm^2)	
	2018	2019	2018	2019	2018	2019	2018	2019
100% mineral N	19.0	19.1	1.85	1.89	16.3	16.5	78.9	79.5
80% mineral + 10% pig. tea + 10% S. plantensis	20.5	20.6	1.94	1.98	17.4	17.3	80.5	80.6
60% mineral + 20% pigeon + 20% S. plantensis	22.0	22.2	1.99	2.12	18.5	18.5	83.2	84.4
40% mineral + 30% pigeon + 30% S. plantensis	23.4	24.5	1.79	2.21	22.2	24.3	91.1	98.3
20% mineral + 40% pigeon + 40% S. plantensis	18.2	19.0	1.74	1.75	16.9	16.6	75.8	77.3
0% mineral + 50% pigeon + 50% S. plantensis	15.5	15.1	1.70	1.72	14.0	13.7	74.5	76.1
New LSD at 5%	0.80	0.9	0.03	0.02	0.9	0.8	1.3	1.0

The illustrated data in Table (4) showed that, Sukkary mango trees received 60% of N fertilizer in form of (30% pigeon manure tea + 30% *Spirulina plantensis*) present the higher chlorophyll a (6.9 & 6.9 mg/100g F.W.), chlorophyll b (3.8 & 4.0 mg/100g F.W), total chlorophylls (10.7 & 10.9 mg/100g F.W.) and total carotenoids (4.3 & 4.7 mg/100g F.W.). However, increasing the ratio of pigeon manure tea + *Spirulina plantensis* than 60%, significantly decreased all studied pigments, this data were true in both experimental seasons respectively. Contrary, trees received 100% of 50% pigeon manure tea + 50% *Spirulina plantensis* and 0.0% mineral N present the lowest contents of chlorophyll a (4.0 & 3.8 mg/100g F.W.), chlorophyll b (1.2 & 1.3 mg/100g F.W.), total chlorophylls (5.2 & 5.1 mg/100g F.W.) and total carotenoids (2.9 & 2.8mg/100g F.W.), during the two experimental seasons respectively.

Effect of Pigeon manure tea and *Spirulina plantensis* on yield and its components

Data concerning the effect of partial replacement of mineral N by using pigeon manure tea + *Spirulina plantensis* on yield (kg/tree), number of fruit/tree as well as fruit weight (g) of Succkar mango trees during 2018 and 2019 seasons are presented in Table (5). It is clearly shown from these data that partial replacement of mineral N by pigeon manure tea + Spirulina plantensis significantly was accompanied with improving yield, number of fruit/tree and fruit weight (g) relative to the control treatment.

This promotion o was in proportional to increase the ratio of organic (pigeon manure tea) and bio (*Spirulina plantensis*) fertilizers from 0.0% to 40%. So, increasing the replacement mineral N ratio over than 40 was accompanied with significant decrease in yield and its components, these data were true during the two experimental seasons.

It is clear from the same Table the highest yield (kg)/tree (65.7 & 66.0 kg), fruit numbers/tree (300 & 305 fruit/tree) and fruit weight (219.1 & 216.5 g) were obtained from the trees received 40% in nitrogen fertilization in form of organic (pigeon manure tea) + bio fertilizers (*Spirulina plantensis* alga). On the opposite side, the lowest yield (kg)/tree (32.0 & 32.3 kg), as well as lowest fruit numbers/tree (200 & 195 fruit/tree) and lowest fruit weight (160.0 & 165.5 g) were obtained from the trees received 100% of nitrogen fertilizers as a form of organic + bio fertilizers, these data were true during the two experimental seasons respectively. Therefore, in

order to significantly improve the yield and its components it may be evidence and economically, suggested that use 40% from N fertilizers as a form of organic (20% pigeon manure tea) + bio (20% *Spirulina plantensis* alga).

Table 4. Effect of replacing mineral N partially by using pigeon manure tea and *Spirulina plantensis* on leaves main pigments of Succkary mango trees, during 2018 and 2019 seasons

Treatments	Chlorophyll a (mg/100g F.W)		Chlorophyll b (mg/100g F.W)		Total Chlorophyll (mg/100g F.W)		Total Carotenoids (mg/100g F.W)	
	2018	2019	2018	2019	2018	2019	2018	2019
100% mineral N	5.4	5.6	2.7	2.6	8.1	8.2	3.3	3.1
80% mineral + 10% pig. + 10% S. plantensis	6.0	6.1	3.3	3.3	9.3	9.4	3.9	4.2
60% mineral + 20% pigeon + 20% S. plantensis	6.7	6.7	3.8	3.9	10.3	10.5	4.3	4.7
40% mineral + 30% pigeon + 30% S. plantensis	6.9	6.9	3.8	4.0	10.7	10.9	3.9	4.1
20% mineral + 40% pigeon + 40% S. plantensis	4.3	4.3	1.5	1.6	5.8	5.9	3.1	3.3
0% mineral + 50% pigeon + 50% S. plantensis	4.0	3.8	1.2	1.3	5.2	5.1	2.9	2.8
New LSD at 5%	0.3	0.4	0.2	0.3	0.4	0.5	0.4	0.6

Similar results were observed by certain authors in fruit trees, such as **Sefan (2009)** on yield and berry quality of King Ruby grapevines. And **Hasan (2015)** when study the replacement of the mineral fertilizers by using plant compost tea enriched with *Spirulina plantensis*, their results confirmed that the productivity in terms of yield and its components of Flame seedless grape. The effect leaf fertilization of Papaya trees with *Spirulina plantensis* on growth and fruiting were studied by **Railene *et al.* (2017)** their results confirmed the positive effect of this algae on yield and its components. Furthermore, the role of using manure tea was extended study by: **Ibrahime *et al.* (2015)** on mango trees *cv*. Keitte and **Mandal *et al.* (2017)** on mango trees cv. Himsagar, these studies clearly distinguished the positive effect of manure tea on enhancing fruit sett and yield and its components.

From the view of previews studies, the positive effect of manure tea, such as pigeon manure tea, due to; it could remarkably improving soil physical, chemical and biological characteristics of all soil types, adjusting the soil pH, increasing mineral elements available for plant absorption. Furthermore, adding organic fertilizers could significantly increase the availability of phosphorus, potassium and calcium as well as micro-elements. Then, using organic or bio fertilizers shortly increases the microbial population in soil and increases the activity of microbial enzymes (**Abou-Hussein *et al.*, 2002** and **Baiea and EL-Gioushy 2015**). Pigeon manure is a readily available fertilizer, it has some beneficial effects on physical and chemical properties of fruits **(Gogoi *et al.*, 2004; Mohammed *et al.*, 2010; Loredana *et al.*, 2015** and **Baiea and EL-Gioushy 2015)**

Table 5. Effect of replacing mineral N partially by using pigeon manure tea and *Spirulina plantensis* on leaves NPK contents (% D.W.) of Succkary mango trees, during 2018 and 2019 seasons

Treatments	Number of fruit/tree		Fruit weight (g)		Yield (kg/tree)	
	2018	2019	2018	2019	2018	2019
100% mineral N	240	250	190.2	192.5	45.6	48.1
80% mineral + 10% pigeon + 10% S. plantensis	272	279	206.3	206.0	56.0	57.5
60% mineral + 20% pigeon + 20% S. plantensis	300	305	219.1	216.5	65.7	66.0
40% mineral + 30% pigeon + 30% S. plantensis	223	235	176.5	180.5	39.4	42.4
20% mineral + 40% pigeon + 40% S. plantensis	211	217	166.5	171.3	35.1	37.2
0% mineral + 50% pigeon + 50% S. plantensis	200	195	160.0	165.5	32.0	32.3
New LSD at 5%	10.0	12	5.0	5.6	3.0	4.6

Conclusion

Under Edfu district, Aswan Governorate, Egypt conditions, in nil valley loamy clay soil, or resampling conditions, it could be strongly recommended to replaced 40% of mineral nitrogen used in fertilizers program of Succkary mango trees by using 20% organic fertilization (in form of pigeon manure tea) + 20% biofertilization (in form of *Spirulina plantensis* alga), in order to improve vegetative growth and predictability of trees (yield "kg/tree", number of fruits/tree and fruit weight "g").

REFERENCES

Abd El-Aal, A.H.M.; Selim, B.M. and Shaker, S.H. (2007). Response of Superior grapevines to application of filter mud, compost El-Nile and green manure. J. Agric. Sci. Mansoura Univ. 32 (12):10300-10309.

Abd El-Hamid, S.A. and El-Shazly, M.M. (2019). Response of mango trees to organic and biofertilization in North Sinai. Egyptian J. Desert Res., 69 (1): 39-66.

Abou-Hussein, S.D., I. El-Oksha, T. El-Shorbagy and A. M. Gomaa, (2002). Effect of cattle manure, bio fertilizers and reducing mineral fertilizer on nutrient content and yield. Egypt. J. Hort., 29 (1): 99-115

Ahmed, F.F. and Morsy, M.H. (1999). A new method for measuring leaf area in different fruit species. Minia j. of agric. Res. & develop. Vol. (19):97- 105.

Annual Reports of Statistical and Agricultural Economics in Arab Republic of Egypt, **(2018)**.

Baiea, M.H.M. and EL-Gioushy, S. F (2015). Effect of some Different Sources of Organic Fertilizers in Presence of Bio-fertilizer on Growth and Yield of Banana cv. Grande Naine plants. Middle East J. Agric. Res. 4(4): 745-753.

Chang, E.H.; Chung, R.S. and Tsai, Y.H. (2007). Effect of different application rates of organic fertilizer on soil enzyme activity and microbial population. Soil Science and Plant Nutrition. 53, 132-140.

De-Oliveira, L.M.; De-Oliveira, A.M.F.; Rocha, R.H.C.; Dias, G.A.; Teodósio, A.M.B.; De-Lima, J.F.; Barbosa, L.D.S. and Guedes, W.A. (2020). *Spirulina platensis* coating for the conservation of pomegranate. AIMS Agric. & Food 5(1): 76-85.

EL-Boray, M.S.; Mostafa, M.F.; Shaltout, A.D. and Hassan, K.H. (2015). Influence of fulvic acid plus some microelements and microorganisms on yield and quality characteristics of Flame seedless grapevines. J. Plant Production, Mansoura Univ., 6 (3):287 -305.

El-Khawaga, A.S. (2011). Partial replacement of mineral N fertilizers by using humic acid and Spirulina plantensis algae biofertilizers in Florida prince peach orchards. Middle East J. of Applied Sci., 1(1): 5-10.

El-Kramany, M.F., Ahmed, M.K.A.; Bahr A.A. and Kasber, M.O. (2000). Utilization of biofertilization in field crop production. Egyptian J. Appl. Sci., 15: 137-149.

El-Shenawy, F. E. and T. A. Fayed (2005). Evaluation of the convential to organic and bio-fertilizers on Crimson seedless grapevine in comparison with chemical fertilization. 2-Yield and fruit quality. Egypt. J. Appl. Sci., 20(1): 212-225.

Eman, E.K. Abd-Ella, E.E.K.; Mervate, S.S. and Wafaa, A.Z. (2010). Effect of Some Organic and Mineral Fertilizer Applications on Growth and Productivity of Pomegranate Trees. Alexandria Sci. Exchange J. 31(3): 296-304.

Gad-El-Kareem, M.R. (2009) Response of Swelling and Floridaprince peach trees to application of some rest-breaking chemicals as well as organic and biofertilization under Sohag conditions. Ph.D. Thesis. Fac. of Agric. Minia Univ. Egypt.

Gogoi, D.; Kotoky, U. and Hazarika, S. (2004). Effect of biofertilizers on productivity and soil characteristics in banana. Indian J. of Hort. 61(4): 354-356.

Hagag, L.F.; Abd El-Migeed, M.M.M.; Shahin, M.F.M.; Mahdy, H.A El-Hady, E.S. (2018). Impact of organic fertilizer and bio-stimulating substances in maximizing productivity and fruit quality of *cv.* "Cyprus" olive trees. Bioscience Research 15(4): 3262-3269.

Haggag, L.F.; Merwad M.A.; Shahin, M.F.M.; Hoballah, E.M. and Mahdy, H.A. (2014). Influence of Mineral NPK and Compost Tea as Soil Applications on Growth of "Aggizi" Olive Seedlings under Greenhouse Condition. Middle East Journal of Agriculture Research, 3(4): 701-706.

Hasan, S.S.A. (2015). influence of reducing mineral nitrogen fertilizer partially by using plant compost enriched with Spirulina plantensis algae on fruiting of Flame seedless grapevines. Ms.C. Thesis, Fac. of Agric. Minia Univ., Egypt.

Ibrahim, H. I.M.; Mohamed, A.Y. and Hassan E. M. Ibrahim, H.E.M. (2019). Using Carboxylic Enriched with Carboxylic Calcium, Algae Extract, and Glycine to Promote Yield and Fruit Quality of

Williams Banana Plants. New York Sci. Journal, 12(1): 17-29.

Ibrahim, H.I.M.; Mansour, A.E.M. and Merwad M.A. (2015). Impact of Spraying some Organic Manure Tea, Seaweed Extract and Royal Jelly on Fruiting of Keitte Mango Trees. Intern. J. of ChemTech Res., 8(4): 2131:2141.

Ibrahim, H.I.M.; Zaglol, M.M.A. and Hammad, A.M.M. (2009). Response of Balady Guava Trees Cultivated in Sandy Calcareous Soil to Biofertilization with Phosphate Dissolving Bacteria and or VAM Fungi. J. of American Sci. USA. 9 (2): 73-85.

Kulk, M.M. (1995). The potential for using Cyanobacteria (blue-green algae) fungi. European J.Plant Pothole., Vol. 10 pp. 585-599.

Litterick, A.M., L. Harrier, P. Wallace, C.A. Waston and M. Wood (2004). The role of uncomposted materials, compost, manures and compost extracts in reducing pests and diseases incidence and severity in sustainable temperate agricultural and horticultural crop production. Plant Science, 23 (6): 453-479.

Litterick, A.M.; Harrier, L.; Wallace, P.; Watson, C. A. and Wood,
M. (2004). The Role of Uncomposted Materials, Composts, Manures, and Compost Extracts in Reducing Pest and Disease Incidence and Severity in Sustainable Temperate Agricultural and Horticultural Crop Production. Critical Plant Sci., 23:6, 453-479.

Loredana, L.; Catello, P.; Donatella, A.; Giuseppe, C.; Massimo, Z. and Marisa, D. (2015). Compost and compost tea management of mini watermelon cultivations affects the chemical, physical and sensory assessment of the fruits. Agric. Sciences, 6: 117-125.

Madany, M.H.G. (2017). Response of Succary mango trees to foliar application of glutathione and boric acid. Master of Since Fac. of Agric. Minia Univ. Egypt

Mandal, S.S.; Sarkar, T.; Das, K. and Datta, P. (2017). Influence of bio-fertilizer and liquid organic manure on growth, fruit quality and leaf mineral content of mango cv. Himsagar. J. of Crop & Weed. 13(1): 132-136.

Mohamed, S.N.S. (2014). Utilization of compost tea and some antioxidant treatments for improving growth characteristics and fruit quality in Le-Cont pear trees. Ph.D. Thesis, Fac. Agric. Cairo Univ., Egypt.

Mohammed, S.M.: Fayed T.A.; Esmail A.F.; and Abdou N.A. (2010). Growth, nutrient statues and yield of Le-Conte pear trees as influenced by some organic and bio-fertilizer rates compared with chemical fertilizer. Bull. Fac. Agric. Cairo Univ., 61: 17-32.

Mostafa, M.; El-Boray, M.S.S.; Abd El-Wahab, A.F. and Barakat, R.A. (2009). Effect of enriched compost tea on Washington navel orange trees. J. Agric. Sci. Mansoura Univ., 34 (10): 10085-10094.

Price, M. and Duddles, N. (1984). Chicken Manure Tea Research Report. ECHO Technical Notes 07-01.

Railene H.C.R.; Jose, F.D.L.; Tádria, C.D.F.: Fernando, J.D.M; Wellinghton, A.G.; Rosana, S.D.A. (2017). Biomass and physiology of papaya seedlings produced under leaf fertilization with *Spirulina plantensis*. Cientifica J. Agric. Sci. 45(4): 398-405.

Russo, R.O. and Berlyn, G.P. (1990). The use of organic
biostimulants to help low input sustainable agriculture. J. Sustainable Agric. , 1(2):19-42 .

Sau, S., Mandal, P.; Sarkar, T.; Das, K. and Datta, P. (2017). Influence of biofertilizer and liquid organic manures on growth, fruit quality and leaf mineral content of mango cv. Himsagar Journal of Crop and Weed, 13 (1): 132-136.

Sefan, R.F. (2009). Effect of adding some organic wastes on yield and berry quality of King Ruby grapevines. Ph.D. Thesis, Fac. of Agric., Mansoura University, Egypt.

Snedecor, G.W. and Cochran, W.G. (1990). Statistical Methods, 7th Ed. The Iowa State Univ. Press Ames. pp 80-100.

Uurman, P.; Van-Lagen, B. and Velthorst, E.J. (1996). Manual for soil and water analysis. Backhuys Publishers Leiden. Pp: 1221.

Von-Bennewitz, E. and Hlusek, J. (2006). Effect of the application of two biopreparations on the nutritional status, vegetative and generative behaviour of Jonagold apple trees. Acta Horticulturae, 721: 129-136.

Ward, G.M. and Johnston, F.B. (1962). Chemical methods of plant analysis. Canada Department of Agriculture, Publication, Pp 1064.

Wilde, S.A; Corey, R.R.; Layer, J.G. and Voigt, G.K. (1985). Soil and plant Analysis for tree culture. Oxford and IBH publishing Co., New Delhi, India pp. 10-120.

RESEARCH ARTICLE

Attempts to Improve Growth and Productivity of Succkary Mango Trees by Using Pigeon Manure Tea and *Spirulina Plantensis* Alga

Authors' contributions

Author details: Ali, H. Ali; Hamdy. I.M. Ibrahim; Ahmed M. Akl and Mahmoud H.G. Madani,
Hort. Dept, Fac. Of Agric., Minia University, **Egypt**.

Funding: NA

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Competing interests

The authors declare that they have no competing interests.

Received: 16 Feb. 2022 **; Accepted:** 16 April 2022

Ready to submit your research? Choose The Future and benefit from:

Fast, convenient online submission
• thorough peer review by experienced researchers in your field
• **Rapid** publication on acceptance
• **Support** for research data, including large and complex data types
• **Gold** Open Access which fosters wider collaboration and increased citations
• maximum visibility for your research is always in progress.
Learn more futurejournals.org/

.

© The Author(s). 2022 Open Access This article is distributed under the terms of the Creative Commons Attribution 4.0 International License (http://creativecommons.org/licenses/by/4.0/), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made. The Creative Commons Public Domain Dedication waiver (http://creativecommons.org/publicdomain/zero/1.0/) applies to the data made available in this article, unless otherwise