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Beneficial effect of organic liquid fertilizer on growth of some olive seedling cultivars

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ABSTRACT

This study was carried out in shade house of National Research Center, Dokki, Cairo, Egypt on the olive seedlings of Picual, Manzanillo, Koratina, Koroneiki and Meraki cultivars to study the influence of application time intervals of pigeon manure tea as liquid organic fertilizer. The seedlings were planted in black polyethylene bags with 30 cm diameter fooled 10 kg washed sand mixed very good with peat moos (2:1), Olive seedlings were irrigated twice weekly. Seedlings were fertilized with recommended dose (0.5gm/seedling/twice/week (control)) of conventional fertilizers which add as crystalon (20:20:20 NPK). Pigeon manure tea used as organic liquid fertilizer applied as soil application at three periods intervals (15, 30 and 45 day) during growing season (March until September). In general, the application of pigeon manure tea as soil application every 45 days gave the best results for increasing all vegetative growth such as plant height, shoots number, trunk diameter, Shoot fresh, dry weight, root numbers, length, root fresh and dry weight, as well as, the application of pigeon manure tea as soil application every 30 days gave the maximum nitrogen, potassium and phosphorus contents in leaves.

Keywords: olive, seedling, pigeon manure tea, liquid organic fertilizer, growth parameters.

1. Introduction

Organic fertilizers contain moderate amount of plant essential nutrients which considered as naturally available mineral sources. Organic fertilizers are able to alleviate problems correlating with synthetic fertilizers and maintain soil fertility by reducing the necessity of repeated application of synthetic fertilizers. Using organic fertilizers Improves healthy growth of crop plants through release nutrients gradually into solution of the soil and maintains nutrient balance, also through improve soil structure where is behave as an effective energy source of soil microbes.

Organic fertilizers are considered as naturally slow releasing fertilizers and they contain many trace elements. Compost tea is simply defined as brewed, water extracts of composted materials which retain all the beneficial soluble bioactive components, making it a potent source of plant stimulatory and defensive compounds. Compost teas contain a significant quantity of total nutrients with the majority being primary macronutrients. Micronutrient and Secondary concentrations are more variable in compost tea, but scanty to sate crop requirements. Compost tea supports crop nutrition directly and indirectly, because it is characterized by its ability to decrease in diseases, additional microbes and increase in nutrients for the soil .

Mechanisms of action of compost tea as nutrient sources was similar to compost, compost tea is a nutrient-rich extract, microbiologically active, which when used as foliar application or soil drench with irrigation water as soil application which influences growth, yield quality and quality directly or indirectly through chemical and/or biological mechanisms. Indirect mechanisms operate principally on the effect of microorganisms within the compost tea on pest suppression and enhancement of microbial communities that affect direct mechanisms of nutrient uptake or production of bioactive compounds. Direct modalities involve increased nutrient supply and action of microbial bioactive compounds including humic acids and phytohormones, Gaius and Micah (2019).

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Siddiqui *et al.,* (2011) observed that the application of compost tea (CT) and in organic fertilizer (NPK) at a rate of CT 50: NPK 50 significantly enhanced the vegetative growth, yield and antioxidant content of the medicinal herb *Centella asiatica* (L.) urban. Similarly, Reeve *et al.,* (2010) reported a synergistic effect when using compost tea in combination with inorganic fertiliser, resulting in a higher shoot (22–61%) and root (40–66%) biomass of wheat seedlings relative to that observed when inorganic fertiliser was applied alone. Sanwal *et al.,* (2007) also demonstrated that the application of poultry manure and compost tea greatly increased the rhizome yield of ginger. In a recent study, Naidu *et al.,* (2013) established that microbial-enriched compost tea, in combination with half strength fertigation nutrients, had a significantly greater effect on the growth and quality of muskmelons than full strength fertigation nutrients or untreated controls (water only).

Indeed, these authors emphasized that the higher concentration of nutrients in the full-strength fertigation treatment might have resulted in a mineral imbalance that hindered the generation of defense-related compounds, thereby leading to increased susceptibility to pathogen attack. Emad *et al.,* (2018) indicated that soil application of green power 150 cm^3 combined with both of pigeon manure tea 30 cm^3 and humic acid 150 cm^3 had a positive effect on improving fruit quality and productivity of 'Assay' olive trees .

The objective of this study was examining the effect of organic liquid fertilizer on growth of olive seedlings grown in shade house. Thus, this present work intended to evaluate the effects of pigeon manure tea on olive seedlings cv. Picual, Manzanilo, Koratina, Koroneiki and Meraki grown under shade house conditions.

2. Materials and Methods

This work was carried out in the experimental research shade net house of National Research Centre, Dokki, Cairo, Egypt during 2019- 2020. For this purpose, healthy one year old olive seedlings and almost uniform was used. The seedlings were planted in black polyethylene bags with 30 cm diameter fooled 10 kg washed sand mixed very good with peat moos (2:1), Olive seedlings were irrigated twice weekly. Seedlings were fertilized with recommended dose (0.5gm/seedling/twice/week (control)) of conventional fertilizers which add as crystalon (20:20:20 NPK). Pigeon manure tea used as organic liquid fertilizer applied as soil application at three periods intervals (15, 30 and 45 day) during growing season (March until September) on olive seedlings cv. Picual, Manzanilo, Koratina, Koroneiki and Meraki grown under shade house conditions.

2.1. Source of organic liquid fertilizer

Pigeon manure tea used as organic liquid fertilizer and prepared by collect a good sized amount of Pigeon manure. Make sure they are dry. If they are not dry, allow them to dry (spread them out somewhere to dry). Put them in an old burlap bag. Weight them. Fill a large plastic barrel with a lid with 10 times the weight of water to Pigeon manures. Place the closed old burlap bagin the barrel add a brick or large rock to give it some weight so that it won't float and let sit 3-4 weeks, stirring regularly stir it well once or twice daily. Haul the bag of manure out of the water. Squeeze it to remove all the excess liquid. Use the tea fertilizer by diluting it 4:1 with water. Use about 30 cm^3 of organic fertilizer in the form of compost tea applied as soil drench application every 15, 30 and 45 days from March to September.

Treatments were arranged in randomized complete block design with five replicates for each treatment and each replicate was comprised of three seedlings. At the end of September, plants of each treatment were removed genteelly with their root system to estimate and record the following data:

2.2. Vegetative growth parameters

1	Plant height (cm).	**4**	Shoot fresh weight (gm).	**7**	Root dry weight percentage
2	Shoots number per seedling.	**5**	Shoot dry weight percentage	**8**	Root length (cm).
3	Trunk diameter (mm).	**6**	Root fresh weight (gm).	**9**	Roots number per seedling.

Leaves mineral content: Nitrogen (N) and phosphorus (P) in leaves were calorimetrically determined according to the methods described by Bremner, *et al* (1999), and Olsen, *et al* (1982),

respectively. Potassium (K) was determined flame photometrically according to the method advocated by Jackson, *et al* (1970).

2.3. Data Analysis

The average biennial data were subjected to analysis of variance and the method of Duncan's was used to differentiate means (Duncan, 1959).

3. Results

In Table (1) data show the effect of time of application on vegetative growth parameters i.e. Seedling height, Shoots number, Trunk diameter, Shoot fresh weight, Shoot dry weight, root fresh weight, root dry weight, root length and root number.

As for the effect of pigeon manure tea application time on olive seedlings vegetative growth parameters without taking olive cultivars in consideration. With respect to shoot fresh weight parameter, it is obvious that application of pigeon manure tea at 45 days intervals recorded the highest significant increase in shoot fresh weight followed by 15 day treatment and 30 day in a decreasing order, while the lowest value of shoot fresh weight was recorded from olive seedlings grow without soil application of pigeon manure tea.

Table 1: Effect of organic liquid fertilizer on shoot growth parameters of some olive seedlings cultivars (average 2019-2020).

Treatments		Shoot fresh weight (gm)	Shoot dry weight percentage (%)	Plant height (cm)	Trunk diameter (mm)	Shoots number per seedling
Picual	**without**	88.06 j	68.68 cd	68.80 h	5.00 g	12.8 d
	45 day	139.32 a	66.41e	82.80 c	7.60 c	12.0 de
	30 day	108.65e	61.91 f	67.50 h	6.25 f	8.8 f
	15 day	126.51 b	66.83 de	77.50 e	7.00 d	8.4fg
Manzanillo	**without**	98.15 h	66.49 e	78.25 e	6.13 f	13.0 d
	45 day	122.2 c	69.48 c	113.50 a	6.50 e	14.5 c
	30 day	112.71 d	62.20 f	80.40 d	6.20 f	8.4fg
	15 day	95.10 i	63.26 f	74.80 f	3.40 k	7.0 gh
Koratina	**without**	35.68 o	79.37 a	41.00 n	2.80 n	4.0 i
	45 day	106.65 f	61.42 f	61.50 i	7.00 d	11.0 e
	30 day	47.65 n	76.58 b	49.00 k	3.00 m	6.0 h
	15 day	72.01 k	69.37 c	53.00 j	4.50 I	7.0 gh
Koroneiki	**without**	65.64 l	75.75 b	60.50 i	4.75 h	6.0 h
	45 day	123.49 c	61.43 f	84.67 b	7.50 c	17.0 b
	30 day	95.12 i	68.88 cd	72.00 g	3.25 l	13.0 d
	15 day	101.41 g	69.23 c	70.67 g	5.00 g	8.0 fg
Meraki	**without**	45.23 n	69.82 c	37.00 o	3.90 j	3.0 i
	45 day	122.2 c	47.63 h	46.50 l	14.50 a	22.8 a
	30 day	112.51 d	49.42 h	46.20 l	8.40 b	22.0 a
	15 day	95.17 i	54.81 g	43.40 m	7.00 d	22.5 a
Means of cultivars	**Picual**	115.64 A	65.96 C	74.15 B	6.46 B	10.46 C
	Manzanillo	107.06 B	65.36 C	86.74 A	5.56 C	10.73 C
	Koratina	65.50 E	71.68 A	51.13 D	4.33 E	7.00 D
	Koroneiki	96.42 C	68.82 B	71.96 C	5.13 D	11.00 B
	Meraki	93.83 E	55.42 D	43.28 E	8.45 A	17.56 A
Means of Sheep Manure Tea	**without**	66.55 D	72.02 A	57.11 D	4.52 C	7.73 D
	45 day	122.77 A	61.27 D	77.79 A	8.62 A	15.45 A
	30 day	95.37 C	63.80 C	63.02 C	5.42 B	11.63 B
	15 day	98.05 B	64.70 B	63.87 A	5.38 B	10.58 C

Means having the same letters within a column are not significantly different at 5% level.

Concerning shoot dry weight percentage, olive cultivars behaved different manner, where highest shoot dry weight percentage was obtained from untreated olive seedlings, meanwhile olive seedlings received pigeon manure tea every 45 days recorded the lowest value, however the other treatments gave intermediate values with significances between them.

As for the effect of pigeon manure tea application time on olive seedlings height and trunk diameter. Data obvious that, olive seedlings soil drenched with pigeon manure tea as organic liquid fertilizer every 45 days achieved the highest values of plant high and trunk diameter, meanwhile olive seedlings grow without fertilizing with pigeon manure tea showed the lowest values. Whereas, applying pigeon manure tea every 15 and 30 days gave more or less intermediate values of plant high and trunk diameter between control and 45 days treatments.

With respect to shoots number per olive seedlings cultivars was affected significantly by timing of pigeon manure tea application. The longest period (45 days) the highest number of shoots per seedling, whereas the lowest value obtained from control treatment. Meanwhile, 15 and 30 days ranked middle number of shoots per olive seedlings, in other words shoots number values recorded 15.45, 11.63, 10.58 and 7.73 for treatments 45, 30, 15 days and control in descending order.

With respect to the response of olive cultivars as means to pigeon manure tea without regarded to application time. Table (1) show that, the highest shoot fresh weight was obtained from picual cultivar (115.64 gm) meanwhile, the lowest value where obtained from meraki cv. (93.83 gm). Concerning shoot dry weight percentage Kroneiki cv. recorded the highest percentage (71.68%) on the contrary Meraki cv. gave the lowest shoot fresh weight percentage (55.42 %). With respect to plant high (cm), Manzanilo cv. recorded the highest value (86.74 cm) meanwhile, the lowest plant high was deticted with Meraki cv. (43.28 cm), concerning trunk diameter (mm) and shoots number Meraki recorded the highest means value (8.45) and (17.56) while Koroneiki cv. recorded the lowest means value (4.33) and (7.00).

With respect to the means of time of application of without regarded to cultivars. Table (1) clear that, the longest time of application (45 days) significantly increased most vegetative growth parameters.

Data in Table (2) showed that, the highest root fresh weight value was obtained from Koroneiki cv. soil drench with pigeon manure tea every 15 days, whereas the highest root dry weight percentage achieved with Meraki seedlings cultivar grow without fertilization with pigeon manure tea, with respect to root length the highest value achieved with Picual cv. soil drench with pigeon manure tea every 45 days, while the highest roots number per seedling abated with Koroneiki cv. soil drench with pigeon manure tea every 45 days.

Also data in Table (2) showed that, the highest root parameters was obtained from olive seedlings received pigeon manure tea without respect of applied as soil drench application every 45 days without respect of seedling olive cultivars. However, highest means of root parameters for olive seedlings cultivars without respect to time of application of pigeon manure tea were obtained in Koroneiki cv. for root fresh weight and root number values meanwhile root dry weight percentage achieved the highest value, on the other hand the highest root length was obtained from Manzanillo cv.

Data in table (3) show the effect of pigeon manure tea on nitrogen, potassium and phosphor percentage in leaves of some olive seedling cultivars namely Picual, Manzanillo, Koratina, Koroneiki and Meraki.

Nitrogen percentage in leaves of seedlings olive cultivars, data in Table (3) showed that application of pigeon manure tea every 30 day during growing season (from first March to the end of September) increased nitrogen leaves content of Koratina olive seedlings up to (2.50 %) recording the highest value, however olive seedlings not fertilized with pigeon manure tea as organic fertilizer (control) showed the lowest nitrogen percentage as noted in leaves of Picual olive seedling (1.30 %) whereas nitrogen percentage in leaves of the other studied cultivars recorded range between (2.5 %) in leaves of Koratina and (1.30 %) in leaves of Picual cultivar.

Means of cultivars in Table (3) cleared that nitrogen percentage significantly differed from cultivar to anther where the highest nitrogen percentage in leaves was achieved in Meraki seedlings cultivar (1.90 %) followed by Koratina (1.84 %), Koroneiki (1.70 %), Manzanillo (1.69 %) and Picual which recorded the lowest nitrogen percentage (1.61 %).

Table 2: Effect of organic liquid fertilizer on root growth parameters of some olive seedlings cultivars (average 2019-2020).

Treatments		Root fresh weight (gm)	Root dry weight percentage (%)	Root length (cm)	Roots number per seedling
Picual	**without**	15.89 l	74.51 d	12.00i	9 k
	45 day	45.88 c	58.48 n	25.00 a	25 b
	30 day	43.5 e	59.63 m	18.50 d	19 d
	15 day	43.96 e	60.28 l	17.00e	13 h
Manzanillo	**without**	18.55 k	69.65 g	20.50 c	14 g
	45 day	48.2 b	56.24 p	22.75 b	16 f
	30 day	39.7 f	57.98 o	22.00 b	20 c
	15 day	22.16 j	62.68 j	22.50 b	9 k
Koratina	**without**	10.25 n	67.80 h	9.00j	4 m
	45 day	31.02 h	74.15 e	20.00 c	12 i
	30 day	10.88 n	70.96 f	11.00 m	10 j
	15 day	22.25 j	69.48 g	15.00g	7 l
Koroneiki	**without**	33.54 g	61.81 k	16.00f	10 j
	45 day	44.96 d	56.52 p	20.50 c	27 a
	30 day	32.81 g	66.81 i	15.50fg	16 f
	15 day	67.46 a	66.78 i	13.00h	17 e
Meraki	**without**	10.23 n	88.56 a	8.50j	14 g
	45 day	27.11 i	75.62 d	16.00f	16 f
	30 day	23.02 j	79.93 b	20.00 c	20 c
	15 day	13.89 m	77.75 c	9.00 j	9 k
Means of cultivars	**Picual**	37.31 B	63.32 C	18.13 B	16.50 B
	Manzanillo	32.15 C	61.64 E	21.94 A	14.75 C
	Koratina	18.60 D	70.60 B	13.75 D	8.25 D
	Koroneiki	44.69 A	62.98 D	16.25 C	17.50 A
	Meraki	18.56 D	80.47 A	13.38 E	14.75 C
Means of Sheep Manure Tea	**without**	17.69 D	72.47 A	13.2 C	10.20 D
	45 day	39.43 A	64.20 D	20.85 A	19.20 A
	30 day	29.98 C	67.06 C	17.40 B	17.00 B
	15 day	33.94 B	67.40 B	15.30 BC	11.00 C

Means having the same letters within a column are not significantly different at 5% level.

As for means of application time intervals of pigeon manure tea in Table (3) it is clear that nitrogen leaves content was significantly affected by application time intervals of pigeon manure tea (15, 30 and 45 days), the highest leaves nitrogen percentage was obtained in 30 day treatment (2.17 %) followed by 15 day treatment (1.77 %) in a significant order however the lowest leaves nitrogen percentage (1.43 %) was detected in olive seedlings not fertilized with pigeon manure tea as organic fertilizer (control).

Results in Table (3) showed that the effect of application time intervals of pigeon manure tea on phosphor percentage in leaves of some olive seedlings cultivars. The values varied from cultivar to another, high phosphor percentage was in Meraki cultivar soil drenched with pigeon manure tea every 30 days (0.337 %) followed by Koroneiki (0.261 %), Picual (0.258 %), Manzanillo (0.210 %) and Koratina (0.208 %) in a decreasing order with no significances between them. However, olive seedlings cultivars not fertilized with pigeon manure tea as organic fertilizer (control) gave the low phosphor percentage in all olive seedlings cultivars.

In Table (3) as for means of cultivars data cleared that phosphor percentage significantly differed from cultivar to another, while high phosphor percentage recorded for Koroneiki (0.230 %) followed by Meraki (0.225 %), Manzanillo (0.190 %), picual (0.185 %) and Koratina (0.163 %) in decreasing order with significant differences. Both of Koroneiki and Meraki values recorded the highest phosphor percentage with no significant differences between them, simelary Manzanillo and Picual cultivars showed intermediate phosphor percentages with no significant differences between them, on the other hand Koratina showed the lowest significant value.

Concerning means of application time intervals of pigeon manure tea in Table (3) data showed that phosphor percentages was significantly affected by application time intervals of pigeon manure tea (15, 30 and 45 days). Highest values were obtained from monthly application (30 days) followed by 45 days and 15

days, while the lowest value was detected in olive seedlings not fertilized with pigeon manure tea as organic fertilizer (control).

Table 3: Effect of organic liquid fertilizer on leaves mineral content (Nitrogen, phosphorus and potassium percentage) of some olive seedlings cultivars (average 2019-2020).

Treatments		N %	P %	K %
Picual	**without**	1.30 f	0.124 a	0.55 a
	45 day	1.44 ef	0.173 a	0.69 a
	30 day	2.08 abc	0.258 a	0.79 a
	15 day	1.61 cdef	0.183 a	0.85 a
Manzanillo	**without**	1.42 ef	0.108 a	0.63 a
	45 day	1.60 cdef	0.180 a	0.69 a
	30 day	1.95 bcd	0.210 a	0.76 a
	15 day	1.77 cdef	0.260 a	0.95 a
Koratina	**without**	1.40 ef	0.136 a	0.53 a
	45 day	1.62 cdef	0.147 a	0.66 a
	30 day	2.50 a	0.208 a	0.72 a
	15 day	1.86 cde	0.162 a	0.90 a
Koroneiki	**without**	1.51 def	0.254 a	0.57 a
	45 day	1.66 cdef	0.274 a	0.62 a
	30 day	1.91 cd	0.261 a	0.85 a
	15 day	1.73 cdef	0.133 a	0.77 a
Meraki	**without**	1.54 def	0.161 a	0.53 a
	45 day	1.76 cdef	0.203 a	0.60 a
	30 day	2.42 ab	0.337 a	0.79 a
	15 day	1.89 cde	0.202 a	0.92 a
Means of cultivars	**Picual**	1.61 D	0.185 B	0.72 A
	Manzanillo	1.69 C	0.190 B	0.76 A
	Koratina	1.84 B	0.163 C	0.70 A
	Koroneiki	1.70 C	0.230 A	0.70 A
	Meraki	1.90 A	0.225 A	0.71 A
Means of Sheep Manure Tea	**without**	1.43 D	0.157 C	0.56 D
	45 day	1.61 C	0.198 B	0.65 C
	30 day	2.17 A	0.255 A	0.78 B
	15 day	1.77 B	0.188 B	0.88 A

Means having the same letters within a column are not significantly different at 5% level.

Potassium percentage in leaves of seedlings olive cultivars, results in Table (3) showed that no significant differences in potassium percentage were detected as either by olive cultivars or the application time intervals of pigeon manure tea (15, 30 and 45 days), the values of potassium percentage ranged between 0.95 % in Manzanillo seedling fertilized every 15 days, however olive seedlings not fertilized with pigeon manure tea as organic fertilizer (control) achieved the lowest potassium percentage in all olive seedlings cultivars.

As for means of cultivars data in Table (3) showed that leaves potassium percentage in all studied olive seedlings cultivars was not significantly affected, where the leaves potassium percentage ranged between 0.76 % in Manzanillo and 0.70 % in Koroneiki seedlings cultivar.

As for means of application time intervals of pigeon manure tea in Table (3) it is clear that was significantly affected, potassium percentage in leaves of seedlings olive cultivars, where highest potassium percentage was recorded at 15 days treatment (0.88 %) while the lowest potassium percentage (0.56 %) was recorded in leaves of olive seedlings not fertilized with pigeon manure tea as organic fertilizer (control).

4. Discussion

The beneficial effects of liquid organic fertilizers on fruit crops (olives) growth and leaf mineral content were mentioned by many investigators, in this respect Laila Haggag *et al.,* (2014) reported that, application of compost tea at 15 cm^3/ seedling as soil drench with or without mineral NPK gave the best results for increasing all vegetative growth such as plant height increment %, number of leaves/ seedling,

dry weight of leaves %, root length and number per seedling as well as nitrogen and potassium contents in leaf of "Aggizi" olive seedlings grown under shade house conditions. Also, Laila Haggag *et al.,* (2015) indicated that, fertilizing olive seedling with 100 gm pigeon manure tea as liquid organic fertilizer decreasing mineral fertilizers used about 25% and gave best results for increasing all vegetative growth parameters such as plant height increment percentage, Lateral shoot numbers, Stem diameter, number of leaves/ seedling, dry weight of leaves %, and root numbers per seedling as well as nitrogen, potassium and phosphorus contents in leaf seedlings of olive seedlings of "Toffahi" and "Picual" cv. grown under shade house conditions. Moreover, Mostafa *et al.,* (2009) reported that, Washington navel orange trees treated with compost tea gave the highest significant increase of shoot length, leaf number/shoot and relatively leaf surface area as well as significant increase in leaf content of nitrogen, phosphorus and potassium compared with control (treated with water only). Furthermore, Mohammed *et al.,* (2010) showed that application of compost tea gave the higher leaf N, P and K contents of pear trees.

5. Conclusion

Using pigeon manure tea as soil application every 45 days is recommended for improving vegetative growth parameters in olive seedlings studied cultivars. From the above results it seems that prolonging the period of application time of liquid organic fertilizers was more effective on olive seedling growth. This may be explained, that liquid organic fertilizers may be act as slow release fertilizer. However, more studies are needed to investigate liquid fertilizer application at longer than 45 day intervals during the period from March to September and the impact on the vegetative growth and mineral leaf content of olive seedling which may save money and effort.

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