Bull. Fac. Agric., Cairo Univ., 68: 371-383 (2017).

CONVERTED OLIVE MILL WASTES TO COMPOST TEA WITH BIOLOGICAL TREATMENT AND ITS IMPACT ON GROWTH AND PRODUCTIVITY OF MANZANILLO OLIVE TREES

(Received: 3.12.2017)

By

Sh. A. Shaheen, A. S. El-Soda and A. F.M. Abd-Elwahab*

*Department of Olive and Semi-Arid Zone Fruits, Horticulture Research Institute, and * Department of Microbiology, Soils, Water and Environment Research Institute, Agricultural Research Center, Egypt*

ABSTRACT

The current study has been carried out through two successive seasons (2013 and 2014) on 12 years old Manzanillo olive trees in a private orchard located 50 km of Cairo-Alexandria road in the north west of Egypt. The main objective of this study was to convert olive mill wastes [pomace and olive vegetable water (OVW)] to compost tea (CT) and studying their effect on growth and productivity of olive trees. Compost tea (CT) was prepared by soaking the mixture of compost and olive pomace (2:1) in either water or the combination of water with olive vegetable water at different rates (25% or 50%). Four microorganisms (*Serratia marcescens, Pseudomonas fluorescens, Phanerochate chrysosporium* and *Trichoderma virdi)* were used in preparing compost tea. Data exerted that the treatment with CT + microorganisms gave the highest shoot length, number of leaves, fruit diameter, flesh/fruit weight. While, using the mixture of compost tea (50%) and olive vegetable water (50%) and incubated with microorganisms recorded the highest leaf area, flowering density, perfect flower (%), fruit set (%), yield, olive oil content, leaf nitrogen and potassium content as well as the highest net profit. Thus, it could be recommended, under the same conditions of this study, to use converted olive mill wastes to compost tea (CT) at the rate of 50% +50% olive vegetable water (OVW) + microorganisms to increase the productivity of Manzanillo olive trees and the net income, which in turn reduces the amount of fertilizer and environmental pollution caused by these wastes**.**

Key words: *olive, pomace, olive vegetable water, compost tea, microorganisms.*

1. INTRODUCTION

Olive (*Olea europaea L.*) is an important perennial crop and it is one of the oldest cultivated trees in the history of the world, about thousands years ago. Olive tree is mentioned in several verses of Quran and in holy books. It is widely distributed tree grown in many arid zones and native to all the countries around the Mediterranean region that provides 97% of olive production of the world. (Aragon and Palancar 2001; Tuck and Hayball, 2002; Aruoma, 2003). Olive oil industry generates large amount of oily waste designated raw olive pomace (lignocelluloses waste) and olive vegetable water (OVW) that contains a large amount of both organic and inorganic matter. So, it is a very valuable product from both economic and environmental points and an asset that reduces the use of chemical fertilizer, provides protection from erosion, and improves soil fertility and bacterial activity.

There is an expansion in worldwide attention for the utilization of natural liquid and beneficial microorganisms to help organic horticulture and sustainable agriculture (Noval and Rezk, 2009). Compost tea is a liquid fertilizer produced by mixing compost with water and culturing for a defined period. The diverse microbial profile in compost tea helps the plant leaves to absorb nutrients from the air, helping the plant root system to extract nutrients from the soil and recycling the organic matter (Hargreaves *et al.,* 2009). An essential reason of delivering compost tea is to exchange microbial biomass, fine particulate natural issue and dissolvable substance of compost into a watery stage that can be utilized to plant surfaces and soils (Pane *et al.,* 2012). A divers array of bacteria has been shown to promote plant growth. (Vessey 2003; Rasouli *et al.,* 2008; Verma *et al.,* 2010).

Serratia marcescens and *Pseudomonas fluorescens*are are a symbiotic N_2 fixation, able to produce plant hormones, solubilization of inorganic phosphate and mineralization of organic phosphate and other nutrients (Malik and Sindhu, 2011 and Page *et al.,* 2012). *Phanerocheate chysosporium* is identified as fungal species which has high potentialities for removing phenolic compounds and degraded lignin and cellulose in olive pomace (Malik *et al.,* 2009; Mohammed, 2011). *Trichoderma viridi,* species of fungus, has an important role in helping plants to cope with environmental stresses such as drought, water logging, nutritional stress and production of enzymes, especially celluloses (Jose *et al.,* 2011). In fact, like all agricultural tools, compost tea is not a silver bullet for solving widespread problems associated with depleted soils or unsustainable farming practices, but has the important role that can be used as a carrier to fine plant nutrients, help plant leaves to absorb nutrients and is considered as a way to build soil structure when applied as drench and optimizes the soil PH *(*Ha *et al.,* 2008 and Pane *et al.,* 2012). So, preparing compost tea by using olive vegetable water and olive pomace is important to improve the fertility statues and productivity (Blanquez *et al.*, 2002; Paredes *et al.,* 2005; Paraskeva *et al.,* 2006; Lefi *et al.,* 2009).

The aim of the present study was to transfer technology using wastes of olive oil extraction (vegetative water and olive pomace) in the preparation of compost tea with biological treatment on the agriculture land and to high light the advantage of these practices on growth, flowering, crop and oil quality and yield.

2. MATERIALS AND METHODS

2.1. Field practices

Field experiments were conducted during two successive seasons (2013 and 2014) on 12 year old Manzanillo olive trees grown in a private orchard located 50 Kilometer from Cairo-Alexandria desert road to investigate the conversion of olive wastes (pomace &vegetable water) to compost tea with biological treatment and studying their effect on vegetative growth, flowering, leaf minerals content, fruit properties, yield and oil content. The trees were grown in sandy soil at the distance of 5x5 meters apart under drip irrigation system. The selected trees were nearly uniform, vigor growth and free from pathological and physiological disorders. The trees received the same cultural managements (irrigation, fertilization, control weed, pests, and diseases). Farm fertilization (compost and mineral fertilization) was applied to the trees according to recommendations of the Ministry of Agriculture, Egypt. Compost was applied at the second week of November in two parallel ditches of 100 x 40 x 30 cm, (length, width and depth, respectively). The ditches surrounded the tree from two directions in the end of canopy shade. Mineral fertilization during season was added at the rate of 100 gm nitrogen + 270 gm potassium + 500 gm of $MgSO_4$ (9.6 % Mg) + 250 gm sulphur + 250 gm boron (Borax)/ tree. Physical and chemical properties of the compost (Table 1) were analyzed according to (Paredes *et al.,* 2005). The soil was analyzed (Table 2) according to (Chapman and Pratt, 1978). Irrigation water analysis is conducted in the Soil and Water Research Institute (SWRI), ARC, as shown in Table (3).

Table (1): Physical, chemical and microbiological analysis of compost.

Parameters	Compost
PH	7.12
EC(ds/m)	4.89
Organic carbon%	23.20
Organic matter %	39.90
Total N (%)	1.95
Total P (%)	0.45
Total K (%)	2.64
NH4 –N (ppm)	188
NO3 –N (ppm)	215
Total–N (ppm)	403
Total count of bacteria (cfu/g)	3.3×10^7
Total count of fungi (cfu/g)	1.2×10^5
Total count of actinomycetes (cfu/g)	1.3×10^6

Table (2): Physical and chemical analysis of the soil.

Particles size distribution		Chemical analysis	
Coarse sand (%)	4.45	EC dS/m (1:2.5)	4.40
Fine sand (%)	76.35	pH (1:2:5)	8.46
Silt (%)	12.9	Organic matter (%)	0.19
Clay (%)	6.30	Organic carbon (%)	0.11
Texture	Loamy sand		
Total nutrients mg/100g		**Total nutrients mg/kg**	
N	0.13	Mn	1.35
P	0.40	Zn	0.46
K	7.40	Fe	1.60

Table (3): Chemical analysis of well's water

E.C.w mmhos	TSS ppm	pH	Cations (meq/l)			
			Mg^{++}	Ca^{++}	K^{+}	Na^{+}
0.84	537.6	7.4	2	4	0.2	2.1
			Anions (meq/L)			
			SO_4^-	Cl^-	HCO_3^-	CO_3^-
			0.2	6.1	2	Few

2.2. Treatments

Forty-two nearly uniform trees were selected for this study. The experiment included 7 treatments represented by 3replicates (2 trees per each).

The treatments were arranged as follows

1) Control (adopted fertilization program in the farm)
2) Compost tea 100%
3) Compost tea100% +* Microorganisms
4) 75% Compost tea +25% Olive vegetable water
5) 75% Compost tea +25% Olive vegetable water+ *Microorganisms
6) 50% Compost tea +50% Olive vegetable water
7) 50% Compost tea +50% Olive vegetable water +* Microorganisms

* Microorganisms **(***Serratia marcescens* and *Pseudomonas fluorescens***)**

Farm mineral fertilization was usually applied for all the trees in this orchard. The control trees received 50 Kg/tree of compost, while, other trees treated with compost tea (T2-T7) received half the amount of farm compost fertilizer (25kg). Compost tea was added as soil application (5 l/tree) at the end of canopy shade each two weeks during the period from the first week of January till the end of fruit set.

2.3. Preparing compost tea

2.3.1. The following materials were involved

- **Compost***:* A mixture of plant manure compost and olive pomace by the ratio of (2:1).
- **Olive mill wastes [pomace (OPW) and vegetable water (OVW)]:** Each of OPW and OW was collected during the late fall and winter season from olive oil three phase extraction in a private farm that the experimental was set. The main traits of physical and chemical properties were determined according to (Berrin *et al.*, 2008) as shown in Table (4).
- **Microorganisms:** The strains *Serratia marcescens*, *Pseudomonas fuorescens, Phanerochate chrysosporium* and *Trichoderma virdi* used in this study were supplied by Microbiology Dept., Soil, Water and Environment Research Center, ARC), Giza, Egypt, according to (Atlas 1995).

2.3.2. Method of preparing compost tea and enriched compost tea

For preparing compost tea /tree, 500 gm of compost (plant manure compost and olive pomace at the ratio 2:1) had been soaked with:

- Either water at the rate of 5l (T2&T3).
- A mixture of water and OVW at the rate of 3.75l of water+1.25 l of OVW (T4 & T5).
- A mixture of water and OVW at the rate of 2.5l of water +2.5 l of OVW (T6 & T7).
- 5 cm of *Trichoderma and Phanerochate* inoculums were added to the ingredient of compost tea in a shaded place for 14 days with a suitable daily stirring in a plastic barrel (Ingham, 2005). Aeration was done at the rate of 4hr/day in the intermittent periods**.** After elapsing of incubation time, the liquid mixture was filtered by100 mesh screen (T2:T7).
- Then 5 cm of *Serratia* and *Pseudomonas* (as a liquid carrier) were added to compost tea (Bio-enriched compost tea) for 7 days to the treatments (T3, T5 & T7) (Page *et al.*, 1982), where all treatments became ready to use.

2. 4. Measurements

2.4.1. Physical and chemical analysis of treated compost tea and OVW with microorganisms: Physical and chemical properties of treated compost tea and OVW with microorganisms were determined at Soil and Water Research Institute (SWRI), ARC, Giza, Egypt.

2.4.2. Vegetative growth characteristics: At the end of each growing season, the following parameters were recorded:

- Average shoot length (cm).
- Leaf density = the number of leaves / shoot

Table (4): Physical and chemical analysis of olive pomace and olive vegetable water.

Olive waste	Parameters							
	PH	EC (ds/m)	Organic carbon %	Organic matter %	Total N (%)	Total P (%)	Total K(%)	Polyphones (ppm)
Olive pomace	6.25	2.40	29.36	50.50	0.79	0.05	1.20	10000
Olive Vegetative water	5.07	5.50	11.01	18.94	0.40	0.0002	0.05	8500

and calculated per meter.

- Leaf area (cm^2): using a planimeter according to (Aly, 2005).

2.4.3. Leaf minerals content: At the first week of August of each season, leaf samples were taken from mid of the current of growing shoots (Piper, 1950), washed with water then dried by air at 70 ^{0}C till constant weight and finally ground. Thereafter, the following determinations were carried out in the acid digested solutions as reported by (Van Shouwonburg,1968).

- Nitrogen was determined by the Micro kjeldahl method (Pregl, 1945).
- Phosphorous was estimated by the method described by (Murphy and Riely, 1962)
- Potassium was flame-photometerically determined according to (Brown and Lilleland, 1946).

2.4.4. Flowering parameters

-Flowering dates: Date of the inflorescence emergence was recorded as the first sign of inflorescence parts appeared.

- Blooming dates: Beginning and end of flowering dates were recorded when 25% and 75%, respectively of the total flowers opened (Hegazi, 1970).

-Blooming periods: Calculated as the days between beginning of flowering and ending of blooming (Mofeed, 2002).

- Inflorescence length (cm): Thirty inflorescences were randomly taken from each replicate and the length of their axis was measured.

-Flowering density: Average number of inflorescences per shoot was recorded and calculated per meter.

- Perfect flower (%):Determined according to Rallo and Fernández-Escobar (1985)

Perfect flowers (%) = No. of perfect flowers / No. of total flowers x 100

2.4.5. Fruiting

- Fruit set on each replicate tree was recorded after 21 days from full bloom according to (Rosa *et al.*, 2008) and their percentages of No. of total flowers /tree were calculated.
- The average yield (kg) was recorded at ripe stage (olive with superficial pigmentation on more that 50% of the skin) for each replicate tree.

2.4.6. Fruits physical characteristics: Fifty fruits at ripe stage were randomly selected in both seasons from each replicate tree to study physical and chemical characteristics of fruits in different treatments according to the following basis:

- Fruit characters: length (cm), diameter (cm) and weight (g.).
- Stones were extracted from the selected fruits to determine their length (cm), diameter (cm), weight (g) and flesh/stone ratio.
- Flesh/fruit weight percentage was calculated according to the following equation:

  Flesh weight (g) = average fruit weight- average stone weight.

  Flesh/fruit (%) = Flesh weight/ average fruit weight x100 according to (Fouad *et al.*, 1992).

2.4.7. Fruit oil content (%): Fruit oil content as dry weight was determined according to (A.O.A.C 1995) method by extraction the oil from the dried fruits with soxelt fat extraction apparatus using petroleum ether 60-80^0 C of boiling point.

2.4.8. Economic evaluation: Economic evaluation was calculated according to Heady and Dillon (1961) as follows:

- Cost of fertilizing with compost/Fadden = number of trees (120) × amount of compost /tree (50 kg) × price of compost (250 L. E/ ton) =1500 L.E
- Total cost of half amount of fertilizing with compost /Fadden = 750 L.E
- Quantity of compost tea used /year [number of soil drench (8) × amount of added compost tea (600 l/Fadden)] = 4800 l /Fadden
- Cost of the compost tea unit (tank+ pipes pvp+ air pump) = 500 L.E.
- Cost of microorganisms/ Fed = price of l (10 L.E.) x number of microorganisms (4) x number of additions (8).
- Fixed expenses = (mineral fertilization, labor, pesticides and others) =2300 L.E.
- Total cost = sum of all costs.
- Total gross income = average yield of two seasons (kg)/Fadden × total price (3 L.E.)
- Gross margin = total gross income - total cost

2.5. Statistical analysis

All data were tested for treatments effects on analyzed parameters by the one-way analysis of variance (ANOVA), according to (Snedecor and Cochran, 1980). Differences between treatments were compared by Duncan's multiple range tests SAS (SAS, 1994).

3. RESULTS AND DISCUSSION

3. 1. Effect of microorganisms on physical and chemical analysis of compost tea and OVW.

The results in Table (5) showed that there were a decrease in PH, organic carbon, and organic matter, while there were increases in the available of phosphor and potassium. The decrease of PH was observed in the treatments of compost tea with olive vegetable water that inculcated with microorganisms comparing with others. This decrease was probable due to the addition of olive vegetable water, while a decrease of organic carbon percentage because of converting to CO_2 as result of decomposition. Moreover, organic matter declined gradually specially in the treatments of compost tea with olive vegetable water inculcated with microorganisms. This could be attributed to degradation into simple compound (Hargreaves *et al.,* 2009). Total carbon losses are usually associated with a decrease in organic matter due to the mineralization (which is directly related to respiration). More of organic N disappears by increasing of the microbial activity. The increase of P and K due to the role of *Serratia marcescens* and *Pseudomonas fluorescensare* for producing plant hormones and organic acids which hold Ca^{++}, that solubilize inorganic phosphate, and mineralize phosphate and other nutrients (Page *et al.*, 2012; Malik & Sindhu, 2011).

3.2. Vegetative growth parameters

With regard to the collected data in Table (6), the longest shoots (31.7 & 33.45 cm) and No. of leaves (168.15 & 172.50) were noticed with trees treated with CT + microorganisms in both seasons, respectively. While, the control was the other way around as it recorded the least values in both seasons. With respect to leaf area values, the differences between the control and other treatments in both seasons were insignificant. These results confirmed the prominent role of compost tea with microorganisms in an active state that thereby improved water nutrient uptake that leads to increase shoot length and produce more branches (Ingham, 2005). The results of El-Taweel *et al.* (2016) confirmed that irrigated olive trees with olive vegetable water treated with bacteria improved vegetative growth parameters. Ammar and Ben (1999); Al–Absi, (2010) declared that, using the olive wastes (OVW and OPW) showed significant increase in young shoot length, the number of new shoots and leaf area on olive trees.

3.3. Leaf minerals content

Response of N, P, K contents in the leaves of Manzanillo olive trees to different treatments under study are shown in Table (7). Data exerted that, the highest nitrogen percentage (1.66 and 1.80%) and potassium contents (1.73 and 1.66%) in both seasons, respectively, were recorded in the experimental trees treated with 50% of compost tea +50% OVW +microorganisms. Meanwhile, there was no considerable statistical increase in leaves phosphorus content in the two studied seasons. The minimum values of leaves N and K contents were recorded by the control in both seasons.

These increases are related to the ability of

Table (5): Physical and chemical analysis of treated compost tea and OVW with microorganisms.

Treatments	Parameters									
	PH	EC (ds/m)	Organic carbon %	Organic matter%	Total N(ppm)	Total P (ppm)	Total K (ppm)	NH4 –N (ppm)	NO3 –N (ppm)	Total–N (ppm)
*CT	7.15 a	4.42 f	5.92 b	10.18 b	97 c	34.49 d	128.70 f	71.60 a	14.0 a	85.60 b
CT+ **microorganisms	6.50 b	4.78 e	5.07 c	8.72 c	95 c	88.47 a	542.50 c	66.49 b	14.31 a	80.80 c
75% CT + 25% ***OVW	6.91 a	5.08 d	4.10 d	7.05 d	119 b	31.03 e	301.85 e	66.49 b	14.31 a	80.80 c
75%CT + 25% OVW + Microorganisms	5.50 c	6.56 b	3.40 e	5.85 d	115 b	49.84 b	686.40 b	72.38 a	15.43 a	87.81 a
50% CT+ 50% OVW	6.20 b	5.22 c	9.00 a	15.48 a	129 a	21.32 f	352.80 d	63.55 c	11.45 b	75.00 d
50% CT+ 50% OVW+ Microorganisms	5.40 c	7.98 a	4.99 c	8.58 c	125 a	41.20 c	707.70 a	70.70 a	15.64 a	86.34 ab

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.

***CT: Compost tea ** Microorganisms: (*Serratia marcescens* and*Pseudomonas fluorescens*) ***OVW: Olive vegetative water**

Table (6): Effect of converted olive mill wastes to compost tea with microorganisms' treatments on some vegetative growth parameters of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	Shoot length (cm)		No. of leaves/meter		Leaf area (cm)^2	
	2013	2014	2013	2014	2013	2014
Control	23.13 d	25.53 d	115.60 g	123.81 e	3.75a	3.69 a
***CT**	26.43 c	25.93 d	131.62 f	136.90 d	3.52 a	3.51a
CT + **microorganisms	31.71 a	33.45 a	168.15 a	172.50 a	3.51 a	3.65 a
CT (75%) +*OVW (25%)**	29.50 b	30.60 b	145.10 d	150.40 c	3.54 a	3.52a
CT (75%) +OVW (25%) + microorganisms	30.11 b	33.00 a	165.44 b	160.20 b	3.64 a	3.54a
CT (50%) + OVW (50%)	29.62 b	31.50 b	150.33 c	153.10 c	3.65 a	3.66a
CT (50%) + OVW (50%) + microorganisms	27.62 c	28.13 c	139.80 e	139.11d	3.76 a	3.70 a

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.
CT: Compost tea** * Microorganisms :(*Serratia marcescens* and *Pseudomonas fluorescens*)**
*****OVW: Olive vegetative water**

Table (7): Effect of converted olive mill wastes to compost tea with microorganisms treatments on leaf minerals contents of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	N (%)		P (%)		K (%)	
	2013	2014	2013	2014	2013	2014
Control	1.40 f	1.37 g	0.51 a	0.53 a	1.13 g	1.42 g
***CT**	1.51 e	1.55 f	0.52 a	0.51 a	1.64 f	1.59 f
CT + **microorganisms	1.60 b	1.70 b	0.52 a	o.53 a	1.67 c	1.62 c
CT (75%) +*OVW (25%)**	1.53 d	1.62 e	0.51 a	o.52 a	1.65 e	1.61 d
CT (75%) +OVW (25%) + microorganisms	1.65 a	1.77 b	0.53 a	0.50 a	1.70 b	1.64 b
CT (50%) + OVW (50%)	1.58 c	1.66 d	0.52 a	0.51 a	1.66 d	1.60 e
CT (50%) + OVW (50%) + microorganisms	1.66 a	1.80 a	0.52 a	0.52 a	1.73 a	1.66 a

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.
***CT: Compost tea **Microorganisms: (*Serratia marcescens* and *Pseudomonas fluorescens*)**
*****OVW: Olive vegetative water**

bio-enriched compost tea to improve the absorption and translocation of N, P and K by leaves tissues. Besides, their contents from considerable amount of soluble mineral nutrients are readily available for the plant uptake. Various studies confirmed the benefitial effect of compost tea on the plant due its direct nutrients supplying and or its microbial functions (Aloran, 2004). Also, these findings are in agreement with the studies reported by Bardi and Malusa, (2012), who mentioned that the positive influence of microorganisms on nutrient uptake is well established. Esitken *et al.* (2003), Paredes *et al.* (2005), Tartoura *et al.* (2005) and Pant *et al.* (2009) proved that, *Serratia marcescens* and *Pseudomonas fluorescens*are were capable of producing IAA and cytokine, have N_2-fixing capacity, and M3 has phosphate- solubilizing capacity. Recently, OVW and OPW are known to increase soil organic matter and the concentrations of essential inorganic elements for plant growth resulting in enhanced soil fertility.

3.4. Flowering parameters

3.4.1. Flowering dates and duration of flowering

As shown in Table (8), all the investigated trees differed in their flowering dates and flowering period. The blooming duration varied between 10-12 days in the control and other treatments. It was 11 days in the trees that received farm fertilization and other treatments without OVW application (except for 75% CT +25% OVW with or without microorganisms). While, the duration of flowering reached 12 days (1st season) in the treatments that received 50% of CT +50% OVW with or without microorganism. In general, the duration of flowering differed from one season to another. These results agree with the observation of Shereen *et al.*, (2011) on Manzanillo olive trees.

Table (8): Effect of converted olive mill wastes to compost tea with microorganisms treatments on flowering dates of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	Beginning of flowering		End of flowering		Duration of flowering	
	2013	2014	2013	2014	2013	2014
Control	20|3	16|3	30|3	26|3	11 days	11 days
***CT**	20|3	16|3	30|3	26|3	11 days	11 days
CT + **microorganisms	20|3	16|3	30|3	26|3	11 days	11 days
CT (75%) + ***OVW (25%)	23|3	20|3	1|4	30|3	10 days	11 days
CT (75%) + OVW (25%) +microorganisms	23|3	20|3	1|4	30|3	10 days	11 days
CT (50%) + OVW (50%)	25|3	23|3	5|4	1|4	12 days	10 days
CT (50%) + OVW (50%) + microorganisms	25|3	23|3	5|4	1|4	12 days	10 days

***CT: Compost tea ** Microorganisms :(*Serratia marcescens* and *Pseudomonas fluorescens*) ***OVW: Olive vegetative water**

3.4.2. Flowering characteristics

Data in Table (9) exerted that there was a convergence between the trees which have been treated with 75% of CT +25% OVW+ microorganisms and 50% of CT +50% OVW+ microorganisms in the inflorescence length and the number of inflorescence /meter, that showing the most pronounced significant increase in both seasons. Regarding perfect flowers (%), the values varied from (41.43 & 47.93 %) in the control to reach (68.20 & 68.60 %) in 50% of CT +50% OVW+ microorganisms treatment, that was true in the 1st and the 2nd seasons, respectively. These results are in a parallel with (Fayed, 2010) who found that all the parameters of length of inflorescences, number of flowers per meter and sex ratio were significantly increased due to the treating of olive trees with enriched compost.

3.5. Fruit set, yield and fruit oil content

The analysis of variance in Table (10) corroborated that, the treated trees with 50% of CT +50% OVW+ microorganisms tend to have the highest significant percentage of fruit set (28.73 and 31.34) and yield (29.13 and 31.20 kg/tree) compared with the control (14.66 and 18.26) (14.94 and 20.35 kg/tree) in both seasons, respectively. The present results are in harmony with those obtained by (Halil *et al.*, 2011) who reported that application of bacterial strains of *Pseudomonas* and *Serratia* during full bloom is thought to have a positive effect on fruit set, Meanwhile, Di-Giovacchino *et al.* (2002) and Altieri and Qlessandro 2008) reported that, using OVW promoted the yield of olive trees. Also, incubation process with microorganisms to the liquid bio-fertilizer (compost + olive pomace +olive vegetable water) could be recommended as liquid application bio-fertilizer for fertigation which apply both water and nutrient into crops at the same time and reduce water and nutrient losses; that led to improve soil fertility and crop growth, while reducing nutrient leaching into the ground water (Bres, 2009). The response to fruit oil content (%) in dry weight to different rates of compost tea is shown in Table (10). Data exerted that fruit oil content of Manzanillo cv. varied from 28.66 to 32.15% in the first season, and from 27.25 to 30.91% in the second season. Adding enriched CT extracted by 50% of compost tea+ 50% olive vegetable water gave the highest oil content (%), while the control treatment was the least in both studied seasons. These results are in a line with (El-Hassani *et al.* (2010) who pointed that increasing oil content in comparison with the control as a result of application of olive mill waste water as an amendment for *menthaspicata* L.

3.6. Fruit physical properties

3.6.1. Fruit length, diameter and weight

Data in Table (11) showed significant increase in fruit physical traits due to different applications of compost tea. In this concern, the maximum fruit length, diameter and weight associated with CT + microorganism and 75% of CT + 25% OVW+ microorganisms) in the two studied seasons as compared with other treatments. However, the minimum values were obtained by the control treatment**.**

3.6.2. Stone length, diameter and weight

The overall tends in the effect of tested treatments were obtained in Table (12). Data revealed that the trees that have been treated with the mixture of 75% of compost tea with 25% OVW and microorganisms gave the highest stone length and stone weight. While, there were no statistically differences between the treatments in the stone weight records in both seasons.

Table (9): Effect of converted olive mill wastes to compost tea with microorganisms treatments on flowering characteristics of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	Length of inf. (cm)		No. of inf. /meter		Perfect flower (%)	
	2013	2014	2013	2014	2013	2014
Control	1.51 f	1.37 f	75.66 d	77.20 e	41.43 g	47.93 g
***CT**	1.53 e	1.55 e	53.41 e	61.72 f	51.37 f	61.73 e
CT + **microorganisms	1.58 d	1.61 d	81.67 b	80.87 d	55.37 e	63.53 c
CT (75%) + ***OVW (25%)	1.60 c	1.66 c	79.54 c	81.33 d	57.47 d	58.80 f
CT (75%) + OVW (25%) + microorganisms	1.75 a	1.74 a	84.00 a	84.66 b	66.13 b	64.17 b
CT (50%) + OVW (50%)	1.65 b	1.70 b	83.56 a	82.83 c	59.00 c	62.17 d
CT (50%) + OVW (50%) + microorganisms	1.77 a	1.75 a	84.59 a	85.43 a	68.20 a	68.60 a

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.

***CT: Compost tea ** Microorganisms :(*Serratia marcescens* and *Pseudomonas fluorescens*) ***OVW: Olive vegetative water**

Table (10): Effect of converted olive mill wastes to compost tea with microorganisms' treatments on fruit set, yield and oil content of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	Fruit set (%)		Yield/ tree (Kg)		Fruit oil content (DW) %	
	2013	2014	2013	2014	2013	2014
Control	14.66 e	18.26 d	14.94 g	20.35 f	28.66 e	27.25 d
***CT**	22.38 c	23.95 c	16.25 f	22.50 e	29.25 d	28.63 c
CT + **microorganisms	25.46 b	28.99 b	21.15 e	26.63 c	30.91 c	29.11 b
CT (75%) +*OVW (25%)**	21.33 d	25.90 c	24.37 c	26.50 c	30.72 c	28.74 c
CT (75%) + OVW (25%) + microorganisms	27.90 a	30.11ab	28.60 b	29.87 b	31.09 b	30.50 a
CT (50%) + OVW (50%)	20.85 d	27.55 b	23.24 d	25.57 d	31.33 b	29.44 b
CT (50%) + OVW (50%) + microorganisms	28.73 a	31.34 a	29.13 a	31.20 a	32.15 a	30.91 a

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.

***CT: Compost tea ** Microorganisms (*Serratia Marcescens* & *Pseudomonas Fluorescens*)**

*****OVW: Olive vegetative water**

Table (11): Effect of converted olive mill wastes to compost tea with microorganisms treatments on fruit dimensions (cm) and weight (g) of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	Fruit length (cm)		Fruit diameter (cm)		Fruit weight (g)	
	2013	2014	2013	2014	2013	2014
Control	2.35 c	2.54 d	1.72 d	1.87 d	5.19 c	4.48 c
***CT**	2.50 bc	2.65 bc	2.03 a-c	2.02 c	5.53 c	5.46 ab
CT + **microorganisms	2.60 ab	2.73 ab	2.12 a	2.18 a	6.41 a	5.60 a
CT (75%) +*OVW (25%)**	2.47 bc	2.55 d	1.77 d	2.08 bc	5.70 b	5.33 ab
CT (75%) +OVW (25%) +Microorganisms	2.70 a	2.75 a	2.06 ab	2.12 ab	6.35 a	5.63 a
CT (50%) + OVW (50%)	2.37 c	2.55 d	1.97 c	2.02 c	5.88 b	5.14 b
CT (50%) + OVW (50%) + microorganisms	2.52 b	2.70 ab	2.06 ab	1.87 d	5.87 b	5.60 a

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.

***CT: Compost tea ** Microorganisms : (*Serratia marcescens* and *Pseudomonas fluorescens*)**

*****OVW: Olive vegetative water**

Table (12): Effect of converted olive mill wastes to compost tea with microorganisms treatments on stone dimensions (cm) and weight (g) of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	Stone length (cm)		stone diameter (cm)		Stone weight (g)	
	2013	2014	2013	2014	2013	2014
Control	1.63 c	1.67 ab	0.84 a	0.83 a	0.843 c	0.811 b
***CT**	1.64 c	1.67 ab	0.89 a	0.84 a	0.863 ab	0.841 a
CT + **microorganisms	1.66 a-c	1.69 a	0.95 a	0.86 a	0.860 a-c	0.846 a
CT (75%) +*OVW (25%)**	1.65 bc	1.66 ab	0.90 a	0.85 a	0.845 bc	0.841 a
CT (75%) +OVW (25%) + microorganisms	1.71 a	1.70 a	0.98 a	0.90 a	0.870 a	0.845 a
CT (50%) + OVW (50%)	1.64 c	1.64 b	0.85 a	0.85 a	0.820 d	0.840 a
CT (50%) + OVW (50%) + microorganisms	1.70 ab	1.69 a	0.91 a	0.86 a	0.847 bc	0.848 a

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.

CT: Compost tea**   * Microorganisms (*Serratia marcescens* and *Pseudomonas fluorescens*)**

*****OVW: Olive vegetative water**

3.6.3. Flesh weight, flesh/fruit weight % and flesh/stone ratio

Data in Table (13) it is evident that, there was a different effect of the treatments during the two studied seasons. Generally, all tested treatments had a significant stimulant effect of flesh /fruit weight (%) as well as flesh/ stone ratio when compared with the untreated ones (control). Whilst, there were no statically differences between the studied treatments and the control in the flesh weight (g) values in both 2013 and 2014 seasons.

The abovementioned results (Tables 11,12,13) imply that, bio-enriched compost tea that mixed with olive vegetable water may provide the trees with maintained micronutrients and growth factors, which improve the photosynthesis process leading to improve physical properties of fruits which are in agreement with Page *et al.* (2012) who mentioned that applied compost tea and co-inoculation with *Phanerochate chrysosporium* on tomato plants led to increase fruit weight. Moreover, soil microbial activity was generally increased by OVW application which enhanced fruit physical properties (Laor *et al.*, 2011). Also, Georgia *et al.* (2010*)* reported an increase in weight of tomato fruit as a result of application olive waste water. According to (Haynes and Swift (1990) and (Noval and Rezk (2009), applying recycling olive oil wastes for the soil improved soil characteristics that led to significant values of fruit quality. Moreover, PGPR strains that produce plant hormones, such as auxins and cytokines, can stimulate plant cell elongation or cell division (Guardiola, 2008).

3.7. Economic study

The economic consideration comparative study of olive Manzanillo cultivar in 2013 and 2014 seasons (Table 14) show that Manzanillo

Table (13): Effect of converted olive mill wastes to compost tea with microorganisms treatments on flesh weight (g), flesh /fruit weight (%), flesh /stone ratio of Manzanillo olive cultivar during 2013 and 2014 seasons.

Treatments	Flesh weight (g)		Flesh /fruit weight (%)		Flesh/ stone ratio	
	2013	2014	2013	2014	2013	2014
Control	4.35 a	3.67 a	83.76 c	81.90 b	5.16 f	4.52 d
***CT**	4.67 a	4.62 a	84.39 bc	84.60 a	5.41 e	5.49 ab
CT + **microorganisms	5.55 a	4.75 a	86.58 a	84.89 a	6.45 a	5.62 a
CT (75%) +*OVW (25%)**	4.86 a	4.49 a	85.18a-c	84.22 a	5.75 d	5.34 b
CT (75%) +OVW (25%) + microorganisms	5.48 a	4.79 a	86.30 a	84.99 a	6.30 ab	5.66 a
CT (50%) + OVW (50%)	5.06 a	4.30 a	86.05 ab	83.66ab	6.17 b	5.12 c
CT (50%) + OVW (50%) + microorganisms	5.02 a	4.75 a	85.57 ab	84.86 a	5.93 c	5.60 a

Means having the same letter(s) within the same column are not significantly differ at the probability of 5 % level according to Duncan's Multiple Range Test.

CT: Compost tea**   * Microorganisms: (*Serratia marcescens* and *Pseudomonas fluorescens*)**

*****OVW: Olive vegetative water**

Table (14): Economic evaluation on Manzanillo olive trees fertilized by different types of converted olive mill wastes to compost tea.

Treatments	Average yield kg/Fed	Cross income /treatment (EPG/Fed)	Total Cost (EP)				Total Cost (EP)	Average net return (EP)
			Fixed Cost	Cost of using compost	Cost of preparing compost tea	Cost of micro-organism		
Control	2117.4	6352.2	2300	1500	---------	---------	3800	2552.2
*CT	2325.0	6975.0	2300	750	216	---------	3266	3709
CT + **microorganisms	2866.8	8600.4	2300	750	216	96	3362	5238.4
CT (75%) +***OVW (25%)	3052.2	9156.6	2300	750	216	---------	3266	5890.6
CT (75%) +OVW (25%) + microorganisms	3508.2	10524.6	2300	750	216	96	3362	7162.6
CT (50%) + OVW (50%)	2928.6	8785.8	2300	750	216	---------	3266	5519.8
CT (50%) + OVW (50%) + microorganisms	3619.8	10859.4	2300	750	216	96	3362	7497.4

olive trees treated by the mixture of 50% of compost tea with 50% OVW and inoculated with microorganisms led to the highest fruit yield (3619.8 kg/Fed) which had the highest net return (7497.4 L.E.) followed by CT (75%) + OVW (25%) + microorganisms treatment as it recorded 3508.2 kg/Fed. for yield and (7162.6 L.E.) for net return. On the other hand, the control treatment gave the least yield (2117.4 kg/Fed.) as well as net return (2552.2 L.E.) in both studied seasons.

Conclusion

The great role of compost tea (CT) fertilization which prepared from olive wastes (olive vegetable water and olive pomace) and supplemented with microorganisms for Manzanillo olive trees, as they are indispensable for improvement of the nutritional status of the trees and the production of maximum yield and fruit quality, as well as minimizing the cost of production and in turn increasing the income of olive orchard. These treatments are safe, effective way of recycling olive oil wastes as a fertilizer, easily adopted by growers and ecological agricultural system. Therefore, it should be recommended the superiority of application of 50% of compost tea with 50% OVW and microorganisms, which gave the best results in yield, fruit quality and achieved the highest net profit in an economic study.

4. REFERENCES

AL-Absi K. M. (2010). Growth and biochemical of olives as influenced by irrigation with tread industrial of olive waste water. J. Plant Nutr., 33:1-14.

Aloran A. A. S. (2004). Effect of compost tea fertilization and Rhizobium inoculation on growth and yield of some lenti varieties. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

Altieri R. and Qlessandro E.A. (2008). Olive orchard with two experimental olive mill wastes mixtures: effects on soil organic carbon, plant growth and yield. Biores. Tech., 99: 8390-8393.

Aly E. A. (2005). Physiological studies on the effect of salt stress on some olive cultivators. Ph., D. Thesis, Fac. Agric., Benha Univ., Egypt.

Ammar E. and Ben R. (1999). Potential horticultural utilization of olive oil processing wastewater. Acta Hort., 474: 741-744.

Aragon J. M. and Palancar M. C. (2001). Imp olive 2000. Present and future of Alpeorujo; Editorial Completeness, S. A., Madrid, Spain.

Aruoma O. I. (2003). Methodological considerations for characterizing potential antioxidant actions of bioactive components in plant foods. Mutation Research-Fundamental and Molecular Mechanisms of Mutagenesis 523, 9-20.

Association of Official Agricultural Chemists (A.O.A.C.) (1995). Official Methods of Analysis. 15th Ed. Published by Washington, D. C., USA.

Atlas R. M (1995). Handbook of Media for Environmental Microbiology. CRC press, 2nd Ed. Boca Raton, Florida, USA, P.716.

Bardi L. and Malusa E. (2012). Drought and nutritional stresses in plant: alleviating role of rhizospheric microorganisms. *In* Abiotic Stress: New Research, N. Haryana and Punj (Eds). Nova Science publishers Inc., Hauppauge, N.Y, USA.1-57.

Berrin S., Ferit C., Birgul E., Ramazan K., Elandsref T., Aylekin B. and Burein C. (2008). The effect of using olive oil vegetation water on some physical and chemical characteristics of soil and nutrient element content of fig (*Ficus carica L*. cv. Sarilop). International meeting on soil fertility land management and Agroclimatology Turkey, P: 393-402.

Blanquez P., Caminal G., Sarra M., Vicent M. T and Cabarrel X. (2002). Olive waste waters discoloration and detoxification in a bioreactor by the *phanerochaete* fungus. Biotech. Progress, 18: 660-662.

Bres W. (2009). Estimation of nutrient losses from open fertigation systems to soil during horticultural plant cultivation. Polish J. Environ. Stud., 18(3): 341-345

Brown J. D. and Lilleland D. (1946). Rapid determination of potassium and sodium in plant material and soil extract by flame photometer. Proc. Amer. Soc. Hort. Sci., 48: 341.

Chapman H. D. and Pratt P. F. (1978). Methods of Analysis for Soils, Plants and Waters. Division. of. Agric. Sci., Univ. California, Berkeley, USA. PP:309.

Di-Giovacchino I., Basti C., Costantini N. and Surricchio G. (2002). Olive vegetable water spreading and soil fertilization. Proc.4th IS on olive growing. Acta Hort., 586: 389-392.

El-Hassani F. Z., Zinedine A., Alaoui M., Merzouki M. and Benlemlih M. (2010). Use of olive mill wastewater as an organic amendment for Menthaspicata L. Indust. Crops & Products, 32, 343-348.

El-Taweel A. A., Aly A. A. and Soha S. M. (2016). Effect of different irrigation regime and olive vegetative water treated with cyanobacteria on soil chemical properties, growth, yield and fruit quality of olive trees. J. plant production, Mansoura Univ., 7 :271-282.

Esitken A. F., Karlidag S. M., Ercisli H. G. and Siddiqui Z.A. (2003). Effect of spraying a growth promoting bacteria on yield and nutrient elements of Apricot trees. Aust. J. Agric. Res., 54: 271-282.

Fayed T. A (2010). Optimizing yield, fruit quality and nutrition status of Roghiani olives grown in Libya using some organic extracts. J. Hort. Sci. Ornamen. Plants, 2: 63-87.

Fouad M. M., Kilany O. A. and El-Said M. E. (1992). Comparative studies on inflorescence emergence, fruit-set and yield of some olive cultivars under Giza conditions. Egypt. J. Apple. Sci., 7:630-644.

Georgia O. G., Zervakis I. and Gaitis F. (2010). Raw and microbiologically detoxified olive mill waste and their impact on plant growth. Terrest. Aqua. Environ. Toxicol. 4 (Special Issue 1): 21-38 Global Science Books

Guardiola J. L. (2008). Increasing citrus fruit size with synthetic auxins. Can J. Microbiol., 47: 77-80.

Ha K. V., Bunemann P. and Marschner E. K. (2008). Dynamic of C,N,P and microbial community composition particulate soil organic matter during residue decomposition . Plant and Soil.,303:253-264.

Halil K. R., Fatih K. E. and Rafet F. S (2011). Effect of plant growth promoting rizobacteria on fruit set, pomological and chemical characteristics, color values, and vegetative growth of sour cherry. Turk. J. Biol., 35: 282-291.

Hargreaves J. C., Adi M. S. and Warman P.R. (2009). Compost tea an effective nutrients amendment in the cultivation of strawberries. J. Sci. Food Agric., 89:390-397.

Haynes R. J. and Swift R. S. (1990). Stability of soil aggregates in relation to organic constituents and soil water content. J. Soil Sci., 41: 73-83.

Heady E. O. and Dillon J. L. (1961). Agricultural production functions. Iowa State University Press. Ames, Iowa, U.S.A.

Hegazi E. S. (1970). Studies on growth, flowering and fruiting of some olive seedling strains under Giza condition M.Sc. Thesis., Fac. Agric., Cairo Univ., Egypt.

Ingham E. R. (2005). The compost tea brewing manual, latest methods and Research. 5th Ed. Soil Food Web Inc., Corvallis, Oregon, USA.

Jose L. R., Raul F. G., Rosario H. and Isidro G. C. (2011). Secondary metabolites from species of biocontrol 2 agent *Tricoderma.* phytochem. Rev. 7:89-123.

Lefi W. K., Shannak B., Al-Shannag M., Al – Anber Z. and Al-Hasan M. (2009). Treatment of olive mill wastewater by chemical and biological processes. Environ. Int'l ,31, 289-295.

Laor Y., Saadi I., Raviv M., Medina S., Erez-Reifen D. and Eizenberg H. (2011). Land spreading of olive mill wastewater in Israel: Current Knowledge, practical experience, and future research needs. Israel J. Plant Sci., 59: 39-51.

Malik D. and Sindhu S. (2011). Effect of co-inoculation with *Pseudomonas* sp. on nodulation and plant growth of chickpea Physiol. Mol. Bio. Plants, 17:25- 32.

Malik S.Y., Haddadin H., Omar I.A. and Butros H. (2009). Biological conversion of olive pomace into compost by using *Phanerochate chrysosporium* and *Trichoderma virdi*. Biores. Tech., 100, 4773-4782.

Mofeed A. S. (2002). Effect of picking date on flowering and fruiting of olive trees. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt.

Mohammed Kh. I. (2011). Biochemical and microbiological studies on olive industrial liquid wastes. Ph.D thesis Department of Biochemistry, Fac. Agric., Cairo Univ., Egypt.

Murphy J. and Riely J. P. (1962). A modified single dilution method for determination of phosphate in natural water. Ann. Chemi. Acta, 27: p:31-36.

Noval O. A. and Rezk A. l. (2009). Role of fertilization in improving quality of some agricultural crops. Int'l J. Acad. Res., 1:59-65.

Page A. L., Miller R. H. and Keeney D. R. (1982). Methods of soil analysis; part 2. Chemical and microbiological properties 2nd Ed American Soc. of Agronomy (Publ.) Madison, Wisconsin, USA.

Page C., Celano G., Villicco D. and Zaccardelli M. (2012). Effect of co-inoculation with *Phanerochate chrysosporium* on tomato with whey compost tea applications. Crop product, 83: 80- 86.

Pane C., Celano G., Villecco D. and Zaccardelli M. (2012). Control of *botrytis cinerea, Alternaria alternate* and *Phyrenochateta lycopersici* on tomato with compost tea applications. Crop Protec., 38: 80-86.

Pant A. T., Radovich J. K., Hue N. V., Talcott S. T. and Krenek K. A. (2009). Compost tea and its impact on influence growth and mineral nutrients in Pake Choi plants. J. Sci. Food Agric., 89: 2383-2392.

Paraskeva P. A., Papadakis V. G., and Diamadopoulos E. (2006). Technologies of olive waste water treatment. J. Chem. Techno. Biotech., 81: 1475-1485.

Paredes C., Cegarra J., Bernal M. P. and Roig A. (2005). Influence olive mill waste water in composting and impact of compost on swiss chard crop and soil prosperities. Environ. Int'l , 31 : 305-312.

Piper C. S. (1950). Soil and plant analysis. Int'l. Sci. Publ., New York,USA, P. 368.

Pregl F. (1945). Quantitative organic micro-analysis. 4th Ed, J. A. Churchill. LTD. London, UK., 126-129.

Rallo L. and Fernández-Escobar R. (1985). Influence of cultivar and flower thinning within the inflorescence on competition among olive fruit. J. Amer. Soc. Hort. Sci., 110: 303- 308

Rasouli S. M., Barinand M. H. and Jalili F. T. (2008). The effect of PGPR inoculation on the growth of wheat. International meeting on Soil Fertility Land Management and Agrolimatology. Aydin Turkey, pp:891-898.

Rosa R, Leon L., Merono I., and Rallo L. (2008). Repining time and fruit characteristics of advanced olive selections for oil production. Aust. J. Agric. Res., 59: 46-51.

SAS (1994). SAS Statistics program, Version 6.4th ed. SAA Inst., Cary, NT.

Shereen A. S., El-Taweel A. A. and Al-Khateeb A. (2011). Effect of using olive vegetative water on growth, flowering and yield of Manzanillo olive trees. J. Amer. Sci., 7(9): 501-510.

Snedecor G. W. and Cochran W. G. (1980). Statistical methods. 7th Ed. Iowa State Univ. Press, Ames, Iowa, USA, PP. 507.

Tartoura E. A., El-Saied A. F. and Abdel-Wahab A. M. (2005). Organic farming using a compost tea made from rice straw. Egypt. J. Appl. Sci., 20: 232-249.

Tuck K. L. and Hayball P. J. (2002). Major phenolic compounds in olive oil metabolism and health effects. J. Nutr. Biochem., 13, 636-644.

Van Schouwonburg J.Ch. (1968). International report of soil and plant analysis, Lab. of Soils & Fertilizers, Agric. Univ., Wageningen, Netherlands.

Verma J. J., Yaday P. J., Tiwari K. N. and Singh V. (2010). Impact of plant growth promoting rhizobacteria of crop production. Int'l. J. Agric. Res., 5: 954-983.

Vessey J. K. (2003). Plant growth promoting rhizobacteria of biofertilizer. Plant and Soil, 255: 571-586.

تحويل مخلفات عصر الزيتون إلى شاى الكمبوست بالمعاملة البيولوجية وتأثيره على نمو وإنتاجية أشجار الزيتون المنزانيللو

شيرين عاطف شاهين - أحمد صلاح الدين السودة - *عاطف فتح الله محمد عبد الوهاب

قسم بحوث الزيتون وفاكهة المناطق شبة الجافة- معهد بحوث البساتين- *ومعهد بحوث الأراضى والمياة والبيئة - مركز البحوث الزراعية- الجيزة – مصر

ملخص

اجريت هذة الدراسة خلال موسمى 2013 و2014 على اشجار الزيتون عمر 12 سنة صنف منزانيللو بمزرعة خاصة بالكيلو 50 بطريق مصر اسكندرية الصحراوى، شمال غرب مصر. كان الهدف من هذة الدراسة تحويل مخلفات عصر الزيتون (التفلة والماء الخضرى) الى شاى الكمبوست ودراسة تاثيرها على نمو وانتاجية اشجار الزيتون. تم اعداد شاى الكمبوست بنقع مخلوط كل من الكمبوست وتفلة الزيتون بنسبة (2: 1) فى الماء او خليط من الماء مع الماء الخضرى بمعدلات مختلفة (25% و50%). تم استخدام اربعة انواع من الكائنات الدقيقة (سراتيا,*Serratia marcescens* – فانيروشيت *Phanerochate chrysosporium)* –باسيدوموناس*Pseudomonas fluorescens* – ترايكوديرما *Trichoderma virdi*) فى اعداد شاى الكمبوست. اوضحت النتائج ان المعاملة بشاى الكمبوست الملقح بالكائنات الدقيقة ادت الى زيادة طول الفرع وعدد الاوراق وعرض الثمار ونسبة اللحم/ للثمرة. بينما ادى استخدام الكائنات الدقيقة مع مخلوط شاى الكمبوست مع الماء الخضرى بنسبة (50% شاى الكمبوست مع 50% ماء خضرى) الى زيادة مساحة الورقة وكثافة التزهيرونسبه الازهار الكاملة ونسبة العقد والمحصول ومحتوى الثمار من الزيت ومحتوى الاوراق من النتروجين والبوتاسيوم وكذلك الحصول على اعلى عائد. من النتائج السابقة يمكن التوصية باستخدام مخلفات عصر الزيتون بخلطة مع شاى الكمبوست بنسبة (50% شاى الكمبوست مع 50% من الماء الخضرى) مع استخدام الكائنات الدقيقة وذلك لرفع كفاءة انتاجية الاشجار وتقليل كمية السماد المضاف والحد من التلوث البيئى الذى تسببة هدة المخلفات.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (68) العدد الرابع (أكتوبر 2017):371-383.