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Effect of Organic and Bio-Fertilization on Vegetative Growth and Leaf Mineral Contents of Manzanillo Olive Trees

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ABSTRACT

This study was carried out during 2012, 2013 and 2014 seasons to investigate the effect of different forms of organic fertilization alone or incombination with bio-fertilizer on vegetative growth, leaf mineral contents of Manzanillo olive trees grown in Ismailia governorate, Egypt. The study was conducted on 15 years old olive trees of Manzanillo cv., planted at 5 X 5 m apart grown in sandy soil, under drip irrigation, system and uniform in shape and received the common horticultural practices. The objective of this study was to study the effect of some combinations of organic fertilizers (sheep manure and Poultry manure) with bio-fertilizer a liquid microbial mixture composed of three different microbes [*Azotobacter chroococcum* (nitrogen fixing bacteria) - *Bacillus megaterium* (Phosphor release bacteria) - *Bacillus circulans* (Potassium release bacteria)] at ratio 1:1:1, on vegetative growth, leaf mineral and pigments content of Manzanillo olive trees. The obtained results showed that (PMB2) Poultry manure + bio-fertilizer 2 liter/tree gave the highest values of all vegetative growth parameters as well as ; shoot length , diameter, number of leaves per shoot, leaf area, pigments content and leaf mineral contents of (N, P, K, Fe, Zn and Mn).

Key words: Organic and Bio fertilization, olive, vegetative growth, leaf pigments and leaf mineral content.

Introduction

Olive (*Olea europaea L)* is one of the most important crops in the Mediterranean region, where it occupies anarea of 8.2 million ha (Boussadia et al., 2010). Olive orchards are invariably subjected to a loss of fertility and soil erosion related to the Mediterranean climate, long periods of drought followed by torrential storms, and a lack of soil cover (Gomez *et al*., 2003, 2004). Olive farming requires efficient fertilizer management, which minimizes the hazards of excessive mineral fertilizers due to their negative environmental impact and maximizes the economic feasibility and cost efficiency of fertilization (Gastal andLemaire, 2002).

According to statistical of Food and Agriculture Organization (FAO, 2013). The world area cultivated with olive trees in 2013 is about 10.244.194 hectares and world production of olive is 20.344.343 tons, most of which is extracted to olive oil and the rest processed mainly to table olive. In Egypt, olive cultivation increased considerably during the last two decades due to the great efforts given by Ministry of Agriculture and Land Reclamation. The introduction of new cultivars resulted in the extension of olive plantation in new reclaimed areas. The last statistics of the Ministry of Agriculture and Land Reclamation (2012) cited that the total acreage grown with olive reached 202,743 feddans, total production reached 563,070 ton. Fayoum, Ismailia, Matrouh, South Sainai, Noubaria and desert road of Cairo/Alexandria are the most important regions of olive production.

In sandy soil, organic fertilization improves soil conditions besides it's an important source of macro and micro nutrition. Many studies showed that addition of manure not only increased organic matter content in the soil but also the available P and exchangeable K, Ca and Mg content (Bhangoo*et al.,*1988). The beneficial effect of the use of organic waste materials as N source is considered as the best management for N fertilization practice (Madejon*et al.,* 2003). Moreover, the addition of different organic forms to the soil encouraged proliferation of soil microorganisms, increased microbial populations and activity if microbial enzymes i.e. dehydrogenase, urease and nitrogenase(Youssef *et al*.,2001 and Abou Hussein *et al*.,2002).

Biofertilizer is a ready-to-use live formulation of such beneficial microorganisms which on application to seed, root or soil, mobilize the availability of nutrients by their biological activity. They help build up the soil micro-flora and there by the soil health. Use of bio-fertilizer is recommended for improving the soil fertility in organic framings. The aim of this investigation is to gain a better understandingthe effect of different forms of organic fertilization alone or incombination with bio-fertilizer on vegetative growth, leaf mineral contents of Manzanillo olive trees grown in Ismailia governorate conditions .

Materials and Methods

This study was carried out during three successive seasons, (2012, 2013 and 2014) in a private orchard located at Ismailia governorate, Egypt. The study was conducted on 15 years old olive trees of Manzanillo cv.,

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planted at 5 X 5 m apart grown in sandy soil, under drip irrigation system and uniform in shape and received the common horticultural practices. The orchard soil and water irrigation analysis are given in (table 1 and 2) according to procedures which are outlined by (Wild *et al.,* 1985).

Table 1: Some physical and chemical analysis of the orchard soil.

parameters	Depth of simple (cm)		
	Surface sample	30 cmdepth	60 cm depth
pH	8.02	8.70	8.11
EC(dSm-1)	3.80	0.80	1.70
	Soluble cations (meq\l)		
Ca^{++}	6.00	2.50	3.00
Mg^{++}	4.00	1.50	1.50
Na^{+}	28.60	4.40	12.90
K^{+}	0.12	0.14	0.78
	Soluble anions (meq\l)		
$CO3^{-}$	-	-	-
$HCO3^{-}$	4.40	2.40	2.00
Cl^{-}	27.20	5.00	13.00
$SO4^{=}$	7.12	1.14	3.18

Table 2: Chemical characteristics of water weal used for the present study.

parameters	values
pH	7.49
EC(dSm^{-1})	4.40
Soluble cations (meq\l)	
Ca^{++}	7.50
Mg^{++}	5.00
Na^{+}	33.1
K^{+}	0.16
Soluble anions (meq\l)	
$CO3^{=}$	-
$HCO3^{-}$	1.60
Cl^{-}	40.00
$SO4^{=}$	4.16

Experimental design:

The treatments will be arranged in a randomized complete block design (RCBD), the experiment contains seven treatments, each contains three replicates and the replicate represented by one tree.The normal horticulture practices that used in the farm were applied to all Manzanillo olive trees except those dealing with bio-fertilization, beside the organic manures sheep manure and poultry manure as a source of nitrogen.

Experimental material:

According to the recommendation of Ministry of Agriculture, Egypt, the olive trees required actual nitrogen yearly (1000 gm / tree / year) equal 5 Kg ammonium sulfate (20.6 % N) or 3 kg ammonium nitrate (33.3 % N)(control). Under the experiment condition ammonium sulfate (20.6 % N) was used.

Organic fertilizer was added by rate (500 gm N /tree / year) Obtained from 25 Kg sheep manure (2.00 % N) per tree or 20 Kg poultry manure (2.5 % N) per tree, organic fertilizer superficially and digged in the soil at the second week of December.The Chemical and physical analysis of organic manure sources for three seasons are given in (Table 3).

Mineral phosphate and potassium fertilizer was added by rate 1.75 Kg of super phosphate (15.5 % P_2O_5) per tree. In addition, 1.50 Kg of potassium sulfate (48 % K_2O) per tree was added as a soil application divided to two equal doses, firstly at the second week of December combined with phosphate and organic fertilizers and secondly at the first week of June.

Microbial cultures and biofertilizers inoculation.Biofertilizer consisted of liquid cultures of three bacteria;*Azotobacterchrococcum; Bacillus megaterium and Bacillus circulans*, kindly provided by the Unit of Biofertilizers, Faculty of Agriculture, Ain Shams University. Each organism was grown separately in batch culture to the late exponential phase of each microorganism (Gomaa, 1995) to give a cell suspension of $5x10^5$; $6x10^7$ and $4x10^7$ cell /ml for*Azotobacterchroococcum*, *B.megaterium* and *B. circulans*, respectively. Cultures were mixed on site then each tree received either 1 or 2 liters of the mix, and this treatment was repeated every two months for three times during the season.

Treatments: Bo-fertilization with two different forms of organic fertilizationin this experiment included seven treatments as follows:

T1 - 100 % mineral nitrogen fertilizer (1000 g N/tree) (control).
T2 - Sheep manure + bio-fertilizer (2 liter/ tree).
T3 - Sheep manure + bio-fertilizer (1 liter/ tree).
T4 - Sheep manure without bio-fertilizer.

T5 - Poultry manure + bio-fertilizer (2 liter/ tree).
T6 - Poultry manure + bio-fertilizer (1 liter/ tree).
T7- Poultry manure without bio-fertilizer.

Table 3: Chemical and physical analysis of organic manure sources.

Character	Sheep manure			Poultry manure		
	2012	2013	2014	2012	2013	2014
Weight of m^3(kg)	550	550	540	530	535	530
Humidity (%)	15	15	13	15	20	15
pH	8.01	8.04	8.09	7.22	7.13	7.20
EC (mm /cm)	13.7	11.59	11.77	14.17	14.4	16.17
Organic matter (%)	31.25	30.45	30.12	33.65	35.16	32.55
Organic carbon	30.22	31.26	30.15	28.00	27.90	27.88
C / N ratio	15.19	15.63	15.08	10.89	11.25	10.89
Total nitrogen (%)	1.99	2.00	2.00	2.55	2.48	2.56
Total phosphorus(%)	0.44	0.51	0.50	1.24	1.33	1.22
Total potassium (%)	5.00	5.16	5.15	5.55	5.58	5.66
Fe (ppm)	817.6	815.4	785.4	577.2	559.6	584.3
Mn (ppm)	346.6	333.2	325.8	239.6	221.8	220.5
Zn (ppm)	56.4	58.9	54.6	105.1	100.3	100.8

Measurements:

On early January of each season, twenty healthy one year old shoots, well distributed around periphery of each tree were randomly selected and labeled (5 shoots toward each direction) for carring out the following measurements.

Vegetative growth:

At the end of each growing season during first week of September the following characteristics were measured.

1. shoot length (cm).
2. shoot diameter (mm).
3. Number of leaves per shoot
4. Leaf area (cm^2) according to (Ahmed and Morsy, 1999) using the following equilibration: Leaf area = 0.53 (length x width) + 1.66.

Leaf mineral content and pigments:

Leaves needed were randomly sampled from the previously labeled shoots per each tree / replicate on the second week of September. Whereas, 2 - 3 leaves from every shoot (4th and 5th leaves) were picked then mixed together as a composite for carrying out the following chemical analysis:

Leaf mineral content:

Leaves sample from each tree / replicate was separately oven dried at 70 º C till constant weight, and then grounded for determination the following nutrient elements (Percentage as dry weight):

N – Using the modified micro – kjeldahl method as lined by Pregl, (1945).
P - Was estimated as described by Chapman and Pratt, (1961).
K – Flamephotometerically determined according to Brown and Lilleland, (1946).
Fe, Zn and Mn as ppm was spectrophotometerically determined using atomic absorption (Model, spectronic 21 D) as described by Jackson. (1973).

Pigments:

Pigments i.e., chlorophyll a, b & carotene as mg/g were colormetrically determined in fresh leaf samples at wave length of 660, 640 and 440 nm for a, b & carotene respectively according to Wettestien, (1957).

Statistical analysis:

All obtained data during both 2012, 2013 and 2014 experimental seasons were subjected to analysis of variances (ANOVA) according to Snedecor and Cochran, (1980) using MSTAT program. Least significant ranges (LSR) was used to compare between means of treatments according to Duncan, (1955) at probability of 5 %.

Results And Discussion

Vegetativegrowth characteristics:

Shoot length (cm):

Data presented in the Table (4) indicted that shoot length was significantly affected with different fertilizer treatments. In this respect PMB2recorded the highest value (25.30,25.80 and 29.86)in the first , second and thired seasons respectivitly. On the other contrary the lowest shoot length was rcorded under SM treatment (23.27) in the first season while PM treatmet recorded the lowest vale (22.39 and 25.55) in the seconand and thired seasons respectivilty . Other treatments were in between.

Shoot diameter (cm):

As shown in Table (4) shoot diameter was statistically affected by different treatments in first and third seasons. While, in the second one there was no significant differences between treatments . Treatment with mineral nitrogen fertilization (MNF100%)resulted in the highest shoot diameter (2.5) in the first season while treatment with PMB2 recorded the hightest soot diameter (2.60 mm) in the third season. On the other hand, the least values of shoot diameter were obtained by PM treatment (2.07, 2.10 and 2.13 mm) in the first, second and third seasons respectively. Other treatments were in between range .

Table 4: Effect of organic and bio-fertilization onshoot length, shoot diameter, no. leaves/shoot and leaf area of "Manzanillo" olives in 2012, 2013 & 2014 seasons.

Treatments	Shoot length (cm)			Shoot diameter (mm)			no. leaves/shoot			Leaf area (cm²)		
	2012	2013	2014	2012	2013	2014	2012	2013	2014	2012	2013	2014
MNF100%*	24.23ab	25.22 a	26.64 b	2.50 a	2.47 a	2.40 ab	29.08ab	30.46 b	30.25cd	4.88a	4.89 a	5.36 b
SMB2	24.70ab	24.62 a	29.00 a	2.43 ab	2.37 a	2.53 ab	29.75 a	28.71 c	32.19bc	5.10 a	5.09 a	4.95 c
SMB1	23.57 b	24.75 a	26.78 b	2.23 ab	2.36 a	2.27 ab	28.52 b	27.51 d	30.69 c	4.55 b	5.03 a	4.86 c
SM	23.27 b	23.40 b	26.55 b	2.10 ab	2.13 a	2.17 ab	24.77 c	26.83 d	27.18 e	4.41 b	4.78 a	4.65 d
PMB2	25.30 a	25.80 a	29.86 a	2.37 ab	2.62 a	2.60 a	29.95 a	31.47 a	34.50 a	4.59 b	5.07 a	5.74 a
PMB1	23.47 b	24.95 a	26.55 b	2.13 ab	2.43 a	2.37 ab	28.87ab	29.47 c	33.56ab	4.45 b	4.92 a	5.60 a
PM	23.55 b	22.39 b	25.55 b	2.07 b	2.10 a	2.13 b	25.12 c	27.74 d	28.33de	4.38 b	4.75 a	4.97 c

Mean in each column with similar letter(s) are not significantly different at 5 % level.
(*)MNF100% =100% Mineral Nitrogen Fertilization(control), SMB2 = Sheep Manure + Bio-fertilizer 2liter, SMB1 = Sheep Manure + Bio-fertilizer 1liter, SM = Sheep Manure, PMB2 = Poultry Manure + Bio-fertilizer 2liter, PMB1 = Poultry Manure + Bio-fertilizer 1liter, PM = Poultry Manure.

Number ofleaves per shoot:

Data presented in Table (4) indicate that, number of leaves per shoot was affected by conducted treatments in the three seasons. PMB2 resulted ihighest significantly number of leaves per shoot (29.95,31.47 and 3450 in the first, second and thired seasons respectivitly . On the other side, the lowest number of leaves per shoot was obtained from SMtreatment since it was (24.77, 26.83 and 27.18) in the first, second and third seasons respectively. Other treatments were intermediate .

Leaf area (cm²):

Data in Table (4) showed that leaf area wasstatistically affected by different treatments in first and third seasons. While, in the second one there was no significant differences between treatments.SMB2 andPMB2 treatments resulted in the largest leaf area in the first and thiredseasons scince it was (5.10 and 5.74 cm^2)respectivitly. On the other contrary the lowest leaf area was found in PM and SM treatments (4.38 and 4.65cm^2) in first and thiredseasons,respectivitly.Other treatment were in between range .

The results agree with Helail*et al.* (2003) who reported that, fertilization with poultry manure increased number of produced shoots, shoot length and number of leaves / shoot on different growth cycle of Washington navel orange. Also, on olive trees Osman *et al.,* (2010) found that all measurements in vegetative growth were significantly increased with all different bio-NPK fertilizer soil applied treatments during the two seasons. In addition, the results agree with Barakat*et al.,* (2012) whoshowed that,the highest leaf area was recorded with organic fertilization plus humic acid followed by organic fertilization alone and organic fertilization plus EM then mineral fertilization alone (control)On navel orange cv. Newhall.On the other hand, these results disagree with Fayed (2005) who found that, chemical fertilization gave the highest vegetative characters of Anna apple trees (trunk and shoot diameter, shoot length and leaf area) as compared with all organic sources (chicken manure, cattle manure, town refuse and farming compost) with or without biofertilizers.

Table 5: Effect of organic and bio-fertilization on chlorophyll and carotene contentof "Manzanillo" olive leaves in 2012, 2013 & 2014 seasons.

Treatments	Chlorophyll A (mg.g^{-1})			Chlorophyll B (mg.g^{-1})			Carotene (mg.g^{-1})		
	2012	2013	2014	2012	2013	2014	2012	2013	2014
MNF100%*	0.95 cd	1.17 ab	1.16 ab	0.69 c	0.99 a	1.06 a	0.69 d	0.77 b	0.85 a
SMB2	1.14 ab	1.05 b	1.10 bc	0.84 ab	0.94 a	0.92 ab	0.78 a	0.72 b	0.69 b
SMB1	1.10 ab	1.18 ab	1.11 bc	0.83 abc	1.01 a	0.79 b	0.76 abc	0.78 b	0.78 ab
SM	0.91 d	1.13 ab	1.00 bc	0.69 bc	0.99 a	0.78 b	0.71 cd	0.76 b	0.74 b
PMB2	1.18 a	1.37 a	1.25 a	0.95 a	1.06 a	1.05 a	0.77 ab	0.91 a	0.80 ab
PMB1	1.08 abc	1.23 ab	1.08 bc	0.81 abc	1.02 a	0.85 b	0.76 abc	0.80 ab	0.75 ab
PM	1.04 bcd	0.98 b	1.02 c	0.75 bc	0.81 a	0.79 b	0.72 bcd	0.72 b	0.76 ab

Mean in each column with similar letter(s) are not significantly different at 5 % level.
(*)MNF100% =100% Mineral Nitrogen Fertilization(control), SMB2 = Sheep Manure + Bio-fertilizer 2liter, SMB1 = Sheep Manure + Bio-fertilizer 1liter, SM = Sheep Manure, PMB2 = Poultry Manure + Bio-fertilizer 2liter, PMB1 = Poultry Manure + Bio-fertilizer 1liter, PM = Poultry Manure.

Leaf pigments content:

Leaf content of chlorophyll A (mg.g^{-1}):

It is clearly noticed that leaf chlorophyll A content was significantly affected by different fertilizers treatments Table (5) in the three seasons of study. The highest leaf chlorophyll A content was found under treatment PMB2 (1.18, 1.37 and 1.25) during in the first, second and thired seasons respectively. On the other contrary SM treatment recorded the lowestleaf chlorophyll A content (0.91) in the first one in this respect . Meanwhile PM gave the lowest values (0.98 and 1.02) in the second and thirdseasons. Other treatments were in between.

Leaf content of chlorophyll B (mg.g^{-1}):

As for leaf content of chlorophyll B data in Table (5) revaled thatleaf chlorophyll B content was significantly affected by different fertilizers treatments in the first and thired seasons respectivitly .While, in the second one there was no significant differences between treatments. PMB2 andMNF100%tratmentsrecorded the highest chlorophyll B content scince it was (0.95 and 1.06) in the first and tired seasons respectively.Meanwhile the lowest leaf content of chlorophyll B was found underMNF100% and PM treatment (0.69 and 0.79) in the first season and thired seasons respectivilty. Other treatments were intermediate.

Leaf content of Carotene (mg.g^{-1}):

Data presented in Table (5) indicted that leaf content of Carotenewas significantly affected with different fertilizer treatments. SMB2, PMP2 and MNF100% recorded the highest value (0.78, 0.91 and 0.85) in this respect in the first ,second and thired seasons respectivitly ..On the contrary, the lowest values were recorded with MNF100% (100% Mineral Nitrogen Fertilization) (0.69)in first season. Also, in second season the lowest significant leaf carotene content was observed with SMB2 and PM treatments (0.72 and 0.72). In addition to in the third one SMB2 treatment recorded the lowest one (0.69) in this respect**.**

The previous results are agree with early findings of Osman, (2010) on olive trees found that, the most increase effect on leaves chlorophyll (A & B) contents was exhibited by such combinations represented of Manzanillo olive trees fertilized with Biomagic foliar spray + the T6 (Kotengin + Biofertilizer + K_2SO_4) from first experiment soil applied treatment.In this respect, Osman and Abd El-Rhman (2010) showed that, applying poultry manure + azotobacter and poultry manure + azospirillum gave the highest total chlorophyll in the two seasons on fig trees. Also, Barakat *et al.,* (2012)on navel orange cv. Newhall indicated that,the best treatment was organic fertilization at high level plus humic acid enhanced by total leaf chlorophyll content, while the chemical fertilization treatments resulted in the significantly lowest leave chlorophyll content. In addition, on Valencia orange trees Faissal *et al.,* (2014)showed that using N as 100% inorganic N or as 37.5% inorganic N + 12.5 organic N + 400 ml effective microorganisms (EM) / tree in improving the total chlorophylls.

Leaf mineral content:

Leaf content of N (%):

Data in Table (6) showed that leaf content of N was significantly affected by different fertilization treatments in the three seasons of study . In addition, leaf content of N was increased in the second and third seasons than in the first one .treatment with PMB2 (Poultry manure + bio-fertilizer 2 liter/ tree)gave the highest leaf content of N (1.67 ,1.98 and 1.85 %) in the first , second and thired respectively. Meanwhile SM in the three seasons of study gave the lowest leaf content of N (1.46, 1.57 and 1.47 %) respectively. Other treaments were in between range .

Leaf content of P (%):

As for leaf content of P % data presented (Table 6) showed that there was no significant difference in leaf content of P in the three seasons of study were detected .

Leaf content of K (%):

Data in Table (6) indicated that leaf content of K was significantly affected by different fertilization treatments in the three seasons. Leaf content of K was increased in the second and third seasons than in the first one. In the first season of the study MNF100% gave the highest leaf content of K (1.38 %), meanwhile in the second and third seasons SMP2 treatment recorded (1.46 and 1.35 %) and PMB2 (1.46 and 1.35 %)leaf content of K in the second and thired seasons respectivitly. Meanwhile SM treatment gave the lowest value in the first and third seasons science it was (1.26 and 1.24 %) and treatment PM (1.23 %) in the second one.

Table 6: Effect of organic and bio-fertilization on macro elementsof "Manzanillo" olive leaves in 2012, 2013 & 2014 seasons.

Treatments	N (%)			P (%)			K (%)		
	2012	2013	2014	2012	2013	2014	2012	2013	2014
MNF100%*	1.57 abc	1.66 cd	1.64 cd	0.247 a	0.253 a	0.267 a	1.38 a	1.29 b	1.34 a
SMB2	1.60 ab	1.72 bc	1.74 bc	0.246 a	0.253 a	0.270 a	1.29 bc	1.46 a	1.35 a
SMB1	1.54 bc	1.65 cd	1.66 c	0.240 a	0.500 a	0.247a	1.27 c	1.32 b	1.26 b
SM	1.46 c	1.57 d	1.47 e	0.243 a	0.247 a	0.200 a	1.26 c	1.27 b	1.24 b
PMB2	1.67a	1.98 a	1.85 a	0.266 a	0.257a	0.273a	1.33 ab	1.46 a	1.35 a
PMB1	1.58 abc	1.81 b	1.82 ab	0.266 a	0.237a	0.267a	1.29 bc	1.35 ab	1.27 b
PM	1.52 bc	1.63 cd	1.55 de	0.243 a	0.217a	0.263a	1.27 bc	1.23 b	1.25 b

Mean in each column with similar letter(s) are not significantly different at 5 % level.
(*)MNF100% =100% Mineral Nitrogen Fertilization(control), SMB2 = Sheep Manure + Bio-fertilizer 2liter, SMB1 = Sheep Manure + Bio-fertilizer 1liter, SM = Sheep Manure, PMB2 = Poultry Manure + Bio-fertilizer 2liter, PMB1 = Poultry Manure + Bio-fertilizer 1liter, PM = Poultry Manure.

Similar results were obtained by Helail *et al*. (2003) who noticed that, poultry manure enhanced leaf N, K content of Washington navel orange. Also, Abd El-Naby *et al.* (2004) reported that, leaf N content was significantly increased due to the addition of chicken manure once in winter or twice in winter and summer.In addition, Osman and Abd El-Rhman (2010) fig trees noticed the sheep manure + azospirillum, poultry manure + azotobacter and poultry manure + azospirillum increased leaf content of N compared with control and other fertilization. Also, poultry manure + azotobacter and poultry manure + azospirillum gave the highest values of leaf phosphorus content. Also on navel orange cv. Newhall, Barakat *et al.,* (2012)found that organic fertilization 45kg/ tree plus 150cm^3 humicacid/tree significantly improved leaves nutritional status through increasing their contents of nitrogen, phosphorus and potassium compared to the chemical fertilizers.On the other hand, Fayed (2005) found that, chemical fertilization gave the highest leaf N, P, K content of Anna apple trees compared with all organic sources (chicken manure, cattle manure, town refuse and farming compost) with or without biofertilizers.

Leaf content of Fe (ppm):

Data presented in Table (7) pointed out that, leaf content of Fe was significantly affected by different fertilization treatments in the three seasons.Leaf content of Fe was increased in the second season than in the first one . In addition, PMB2treatment gave the highest leaf content of Fe (288.2,2.99 and 304.6 ppm) in the first, second and thired seasonsrespectivilty. Meanwhile,treatment SM (sheep manure) gave the lowest leaf content of Fe in the three seasons (208.8, 248.2 and 263.3 ppm) respectively.Other treatments were in between.

Table 7: Effect of organic and bio-fertilization on micro elements of "Manzanillo" olive leaves in 2012, 2013 & 2014 seasons.

Treatments	Fe (ppm)			Zn (ppm)			Mn (ppm)		
	2012	2013	2014	2012	2013	2014	2012	2013	2014
MNF100%*	259.4 b	286.7 a	283.6 c	24.73 b	29.50 b	28.00 ab	28.27c	30.07 ab	31.20 b
SMB2	285.1 a	289.7 a	285.5 bc	30.13 a	31.33 ab	29.57 a	32.03b	32.93 a	33.20 a
SMB1	235.6 c	258.6 bc	264.6 d	25.07 b	26.47 c	28.27 ab	28.10c	27.40b	29.00 cd
SM	208.8 d	248.2 c	263.3 d	19.20 c	25.37 c	26.00 b	16.33d	26.73 b	27.13 d
PMB2	288.2 a	299.9 a	304.6 a	32.40 a	33.30 a	30.90 a	38.63a	34.40 a	30.33 bc
PMB1	279.5 a	287.6 a	302.5 a	31.83 a	29.50 b	28.13 ab	28.70c	30.27 ab	28.73 cd
PM	258.1 b	264.7 b	294.9 ab	24.00 b	24.93 c	27.53 ab	26.73c	25.73 b	28.40 cd

Mean in each column with similar letter(s) are not significantly different at 5 % level.
(*)MNF100% =100% Mineral Nitrogen Fertilization(control), SMB2 = Sheep Manure + Bio-fertilizer 2liter, SMB1 = Sheep Manure + Bio-fertilizer 1liter, SM = Sheep Manure, PMB2 = Poultry Manure + Bio-fertilizer 2liter, PMB1 = Poultry Manure + Bio-fertilizer 1liter, PM = Poultry Manure.

Leaf content of Zn (ppm):

As shown in Table (7), leaf content of Zn was significantly affected by different fertilization treatments in the three seasons of study .The highest leaf content of Zn was found under treatment PMB2 (32.40 , 33.30 and 30.90 ppm) during the first, second and thiredseasons respectively. On the other contrary, the lowest leaf content of Znwas obtained from SM treatment since it was (19.20and 26.00 ppm) in the first and third seasons

respectively while PM treatment recorded the lowest one (24.93)in the second season . In addition , other treatment in between range .

Leaf content of Mn (ppm):

Data in Table (7) showed that, leaf content of Mn was significantly affected by different fertilization treatments in the three seasons of study . Poultry Manure + Bio-fertilizer 2liter(PMB2) gave the highest leaf content of Mn (38.63 and34.40 ppm) in the first and second seasons respectively . Meanwhile in the third one treatment SMB2 gave the highest leaf content of Mn (33.20 ppm)andSM (sheep manure) gave the lowest leaf content of Mn (16.33 ppm). On the other contrary the lowest leaf content of Mn was found under treatment SM (16.33 and 27.13) in the first and third seasons respectively . While in the second one PMtreatmentrcorded the lowest one . These observations are in accordance with those obtained by El-Kramany *et al*., (2000) who indicated that phosphate solubilizing and nutrients mobilizing microorganisms which play an important role in the availability of metals and their forms in the composted material and their forms in the composted increased available minerals and their forms in the composted material and increases levels of extractable Fe, Zn, and Mn. In this manner, Helail *et al.*, (2003) showed that, poultry manure enhanced leaf Fe, Zn and Mn content of Washington navel orange. Moreover, On olive trees, Osman (2010) showed obviously the Coronaiki cultivarincrease in leaf N; K; Fe; Mn and Zn contents effect was observed with the combination between Coronaiki trees x Biomagic foliar spray + T6 in 1st experiment soil applied (Kotengin + biofertilzer + K_2So_4) during the two seasons of study.

Conclusion

From the abovementioned results, we can conclude that all soil application of different organic and biofertilizer had a positive effect on increased vegetative growth, leaf mineral and pigments content as compared with control of Manzanillo olve trees. (PMB2) Poultry manure + bio-fertilizer (2 liter/ tree) was the best treatment for increase all vegetative growth parameters as well as ; shoot length , diameter, number of leaves per shoot, leaf area, pigments content. In addition, PMB2 also was the most effective treatment for enhancing leaf mineral contents of (N, P, K, Fe, Zn and Mn).

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