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EFFECT OF BIO AND ORGANIC FERTILIZERS ON VEGETATIVE GROWTH AND LEAF MINERAL CONTENT OF KALAMATA OLIVE TREES UNDER NORTH SINAI CONDITION

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ABSTRACT

"Kalamata" olive trees (*Olea europea* L.) about 10-years-old of nearly moderate vigor and productivity grown in sandy loam soil were selected. The trees were planted at 6×7 m apart under drip irrigation system. All trees received regularly the annual horticultural practices as usually adopted in the orchards. The four organic fertilizer sources *i.e.,* fish scrap 2.5 Kg/ tree/ year, goat manure 16.8 Kg/tree/year, chicken manure 7.8 Kg/tree/year and olive pomace 8.5 Kg/tree/year; were applied with combination of biofertilizers Nitrobein 150 g/tree/year and Protamine® 1.5% and dissolving in one liter of water then added to the soil at three times, at 70% full-bloom, after fruit set and a month later. According to the results obtained in this study, it is possible to recommend the use of organic fertilization, especially fish scrap, through the addition of bio-fertilization using Nitrobein with amino acid Protamine at a concentration of 1.5% combined. This treatment improved the vegetative growth and the leaf mineral content of olive trees to protecting the environment from the problems of pollution resulting from mineral fertilization as well as the use of environmental waste.

Key words: Bio-fertilizers, organic fertilizers, vegetative growth, kalamata and leaf nutrient.

INTRODUCTION

Olive (*Olea europaea* L.) is an evergreen tree grown primarily between 30° and 45° latitudes in both hemispheres. Egypt is considered one of the major producers of olive worldwide. Moreover, Egypt is the leader in growing olive in arid and semi-arid conditions on desert lands. According to statistics data of the **Ministry of Agriculture and Land Reclamation (2016)**, the total acreage of olive orchards reaches 227683 faddan, with average production of 4.213 ton/ faddan. Olives are used locally as table olives and as a source of oil. This investigation aimed to study the effect of different organic and bio-fertilization sources and Protamine amino acid on growth parameters and production of Kalamata olive trees under North Sinai condition. The application of organic manure has been found, to have higher comparative economic advantage over the use of inorganic fertilizer **(Usman, 2015)**. The use of bio-fertilizers can improve productivity per unit area in a relatively short time and fruit quality and yield **(Mosa *et al*., 2014).** Studies have proved that amino acids can directly or indirectly influences the physiological activities of plant growth and development **(Haggag *et al*., 2015)**.

MATERIALS AND METHODS

The investigation was carried out during the two consecutive seasons of 2015 and 2016 at the Experimental Station of the Faculty of Environmental Agricultural Sciences, Arish University, North Sinai Governorate, Egypt, to study the effect of organic and biofertilizers as well as Protamine amino acid together with the control on growth and productivity of "Kalamata" olive trees.

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Ten years old of "Kalamata" olive trees planted at 6 × 7 m apart in sandy loam soil under drip irrigation system were devoted for this investigation. The mechanical and chemical analyses of the experimental soil and water quality are reported in Tables 1 and 2, respectively according to **Piper (1947) and Jackson (1958)**.

All control trees received the regularly annual horticultural practices as usually adopted in the orchard such as:

- Nitrogen was annually applied at the rate of 1500 g ammonium sulfate (20.6% N) / tree.
- Phosphorus as superphosphate (15.5% P_2O_5) was annually added at rate of 1500 g/tree.
- Potassium as potassium sulphate (48% K_2O) was added at rate 500 g /tree/year.
- No organic or other chemical fertilizers were used.

Seventy-eight "Kalamata" olive trees healthy, nearly uniform in growth vigor and productivity were selected for this study.

However, two factors (organic fertilizers sources and biofertilizers as well as amino acid) were studied during the present investigation as follows.

On mid- December of each seasons, different organic fertilizer sources were applied in two trenches digged on both sides of the tree at 75 cm apart from the trunk, and covered with trench soil. Different sources of organic fertilizations were applied excreta (chicken and goat manures), plant residues (olive pomace) and animal byproducts (fish scrap). The chemical analysis of tested organic fertilizer materials was measured (Table 3).

According to the recommendation of Water and Soils Research Institute Ministry of Agriculture, Egypt. The actual nitrogen (g/tree/year) required to olive tree older than 6 years is 500 g/tree/year.

Thereupon, half of the required nitrogen (250 g N/tree) was suggested to be satisfied through one of the organic manure sources according to its content of nitrogen as follows:

- Chicken manure: (3.12% N about 8.01 Kg. tree/year).
- Fish scrap: (8.1% N about 3.09 Kg. tree/ year).
- Goat manure: (1.05% N about 23.81 Kg. tree/year).
- Olive pomace: (2.1% N about 11.90 Kg. tree/year).

The remaining N-requirement for each tree was assumed to be partially satisfied through using N-fixing fertilizers. Nitrobein fertilizer containing *Azospirillum* spp and *Azotobacter chroococcum*. These products are produced by the general organization for agric. Equalization fund, Ministry of Agriculture, Egypt **(GOAEF Ministry of Agric. Bulletin, 1999)**. On early march of each season, dose of the biofertilizers application were 150 g from Nitrobein per tree and applied in trenches (40 cm length × 20 cm width × 15 cm depth).

Amino acid mixture (commercial name "Protamine®) is a plant growth bio stimulating amino acid 84 /45 which contains 18 mixed amino acids. The total percent of amino acids in the product is 84% (16 % as free amino acids in L-α type) + 10.08% organic nitrogen + 3.36% potassium oxide). The previous mixture was added to tree by dissolving the previously mentioned doses at concentration 1.5% and dissolving in one liter of water then added to the soil in the area of drippers and these doses applied through growing season three times at 70% full-bloom, after fruit set, and a month later. Olive trees were treated with bio-fertilizer and amino acid alone or in both as follow:

- Nitrobein alone (150 $g/tree^{-1}$).
- Protamine alone at 1.5%.
- Nitrobein (75 $g/tree^{-1}$)+ Protamine at 1.5%.

Table 1. Soil physical and chemical analyses.

Parameter		Soil depth (cm)		
		(0 – 25)	(25 – 50)	(50 – 75)
		Physical analysis		
Sand (%)		89.39	83.73	78.65
Silt (%)		4.51	8.93	12.70
Clay (%)		6.10	7.34	8.65
Soil texture		**Loamy sand**	**Loamy sand**	**Sandy Loam**
		Chemical analysis		
Cations ($meq.l^{-1}$)	Ca^{++}	6.72	7.95	12.37
	Mg^{++}	5.10	5.87	8.03
	Na^{+}	8.67	11.28	13.37
	K^{+}	0.40	0.36	0.35
Anions ($meq.l^{-1}$)	CO_3^{--}	-	-	-
	HCO_3^{-}	2.45	2.36	2.69
	Cl^{-}	10.41	12.63	13.22
	SO_4^{--}	8.03	10.47	18.21
E.C ($dS.m^{-1}$)		2.89	2.55	3.43
pH		7.9	8.3	8.7
Organic matter (%)		0.18	0.13	0.09

According to **Piper (1947)**

Table 2. Chemical analysis of well water used for irrigation.

Parameter	Value
E.C ($dS.m^{-1}$)	3.20
Concentration (ppm)	2048
pH	7.5
Soluble cations ($meq.l^{-1}$)	
Ca^{++}	8.64
Mg^{++}	6.03
Na^{+}	15.05
K^{+}	0.50
Soluble anions ($meq.l^{-1}$)	
CO_3^{--}	-
HCO_3^{-}	2.62
Cl^{-}	22.26
SO_4^{--}	5.34

According to **(Jackson, 1958).**

Table 3. Chemical analysis of tested organic fertilizer materials.

Material	Total N (%)	Total P_2O_5 (%)	Total K_2O (%)	Total CaO (%)	Total MgO (%)
Chicken manure	3.12	1	0.9	0.4	0.3
Fish scrap	8.1	6.2	-	7.9	0.4
Goat manure	1.05	1.1	2.2	1.5	0.1
Olive pomace	2.1	1.2	1.3	0.5	0.4

Consequently, this investigation is considered a factorial experiment including two factors (4 organic manure sources × 3 biofertilizers together with amino acid). The treatments were arranged in a randomized complete block design and each replicate was represented by two trees in three replications. Additionally, to control treatment content two trees in three replications.

The effect of organic manure sources and biofertilizers (N fixing bacteria) plus Protamine amino acid as well as their interaction on tree growth and leaf nutrient contents was handled as follows:

Vegetative Growth

On late March, for each tree, five similarly branches distributed around the tree canopy were labeled in each season. Tree height (m), tree canopy volume (m), shoots length (cm), number of leaves per shoot and leaf area (cm^2) were recorded and leaf photosynthetic pigments content were determined.

Tree canopy volume calculated using a manual method. One of the most used considers the tree volume as the volume of a cube enclosing the whole tree. Each side of such a cube is measured manually with a measuring tape. The method mentioned in (**Claudio *et al*, 1999).**

The leaf area was calculated using the following formula:

$$L.A\,(cm^2) = \frac{LFW}{\text{Disk fresh weight}} \times \text{Area of disks}$$

Where:

LA = Leaf area (cm^2)

LFW = Leaf fresh weight (g).

In both seasons, leaf samples consisting of 20 mature fresh leaves from spring cycle were selected from the middle of each new shoot and taken in September to determine the leaf chlorophyll a, b and carotenoids content according to the following method which reported by **Wensttein, (1958)**.

The pigments were extracted by 85 % acetone according to the method described by **(Arnon, 1949)**. The optical density of chlorophyll A, B and carotenoids were measured colorimetrically at wave length of 662, 644 and 440 mμ, respectively. The determined pigments were calculated as mg/g^{-1} fresh weight (f.w) of leaf and calculated according to **Wensttein, (1958)** using the following equations:

Chlorophyll A. (mg/100g f.w) = (9.784 × E662) – (0.99 × E644)

Chlorophyll B. (mg/100g f.w) = (21.426 × E644) – (4.65 × E662)

Carotenoids (mg/100g f.w) = (4.495 × E440) – 0.268 (Chl A. × Chl B.)

Where:

E = Optical density at given wave length (λ).

Leaf Mineral Contents

During late September of both seasons, 10 mature leaves were taken from the middle of every new shoot growth of labeled fruit shoot base from current season, leaf samples were dried at 70°C until constant weight then ground to a powder and used for mineral content determination. A suitable sample (0.2 g) was taken from each dried ground leaves and wet digested using a mixture of Perchloric acid: Sulphuric acid (1:4 *V/V*) (**Piper, 1947**) until clear solution. Thereafter, in each leaf sample the mineral content [Nitrogen (%) and Phosphorus (%), Potassium (%), Calcium (%), Magnesium (%) and Iron (ppm)] was determined as follows:

Nitrogen (N %) content was determined using the micro Neslar method as described by **Bremner and Mulvaney (1982).**

Phosphorus (P %) content was determined calorimetrically using the Spectrophotometer **(Model 1600 Jenway Co.)** according to **Jackson (1958).**

Potassium (K %) content was determined using the flame photometer according to **Brown and Lilliland (1946).**

Calcium (Ca %), magnesium (Mg %), and iron (Fe ppm) concentrations were determined using the Atomic Absorption Spectrophotometer **(Perkin-Elmer Model 305B).** All determinations were carried out by using air-acetylene gas mixture at rate of 5:1 L. min-1.

Statistical Analysis

Data recorded in both seasons were subjected to analysis of variance by using MSTATC computer program (**Russell, 1986**) and means were differentiated using Duncan's multiple range test at (0.05) level of significance (**Duncan, 1955**).

RESULTS AND DISCUSSION

The use of some organic and biofertilizers N-fixing bacteria (Nitrobein) as well as amino acid (Protamine) for "Kalamata" olive trees fertilization under North Sinai conditions have been handled in three main stages as follow:

Tree Height (m)

Regarding, the interaction effect between organic fertilizer sources and biofertilizers Nitrobein as well as Protamine, Table 4 reveals that the fish scrap with (Nitrobein + Protamine) were highly interactive for tree height, however the control trees had the least value of tree height in both seasons. The other interactions came in between effect. These results are in agreement with those reported by **Yousef *et al.* (2011b)**. From the abovementioned results, it is clear that treatment (humic acid + amino acids + macro elements + trace elements) was the most effective one compared with the other treatments. Since this treatment gave the best results concerning plant height.

Tree Canopy Volume (m^3)

It is quite evident from Table 4 that the tested treatments significant effected canopy volume (m^3) of kalamata olive tree in the two seasons. The goat manure with Nitrobein were highly interactive for tree canopy circumference. However, the control treatment had the least values of tree canopy circumference in both season, while in second season Fish Scrap with all biofertilizers Nitrobein and Protamine had used an increase in tree canopy circumference. The other interactions came in between effect. In the similar study amino acids at 0.5% + micro elements at 0.25%, gave the best results concerning height and diameter of the tree, the number of branches, the number of leaves and leaf area comparing with the control **Yousef *et al.* (2011a)**.

Shoot Length

The fish scrap application with Nitrobein were highly interactive for shoot length, in both seasons. On the contrary, olive pomace with Nitrobein had the least value in first season and the control treatment had the least value in second season. The other interactions came in between effect.

Number of Leaves / Shoot

Results in Table 5 show that fish scrap with Nitrobein gave the highest values in No. of leaves/shoot (32.80) in first season. While, goat manure with Nitrobein + Protamine and fish scrape with Nitrobein or Protamine gave high values of No. of leaves/shoot (20.97, 20.60 and 20.07) in second season, respectively. On the contrary, the control trees had the least values during both seasons. The other interactions came in between effect.

Leaf Area (cm^2)

Data presented in Table 5 illustrate significantly that, the leaf area was significantly increased by adding organic fertilizer sources compared to the control trees. The highest values of leaf area were observed in chicken manure with Nitrobein treatment (4.993 cm^2) in first season. While, chicken manure or fish scrap with Nitrobein treatments recorded the highest values of leaf area (5.740 and 2.663 cm^2), in second season, respectively. On the other hand, control treatment had the least values (2.243 and 2.897 cm^2) in both seasons. The other interactions came in between effect. Generally, it can be discussed that many studies reported that fertilizing advantage of organic fertilizers is due to their content of stabilized organic matter and due to their component of nutrient elements **(Bevacqua, and Mellano, 1993)**.

Leaf Photosynthetic Pigments (mg/ 100 g $f.w^{-1}$)

It is clear from Table 6 that the interaction effect between organic fertilizer and Nitrobein and Protamine were significantly affected photosynthetic pigments (Table 6). Furthermore, the fish scrap application with Protamine induced more simulative effect on chlorophyll a (17.64 and 18.84 mg/100g f.w) in both seasons, respectively. While, the control treatment had the least value in this respect. The other interactions came in between.

Table 4. The interaction effect between organic fertilizer sources and biofertilizers Nitrobein and Protamine on tree parameters of "Kalamata" olive trees during 2015 and 2016 seasons.

Treatment		Tree height (m)		Tree canopy volume (m^3)	
		2015	2016	2015	2016
Goat manure	Nitrobein	3.963cd	4.410 cd	13.60 a	11.94 c
	Nitrobein + Protamine	4.033 cd	4.480 cd	11.03 ab	12.31 b
	Protamine	3.803de	4.250 de	10.58 b	11.73 c
Olive pomace	Nitrobein	3.150 f	3.597 f	9.890 b	10.66 f
	Nitrobein + Protamine	3.590 e	4.037 e	10.35 b	11.12 de
	Protamine	3.130 f	3.577 f	10.13 b	10.90 ef
Chicken manure	Nitrobein	3.847 de	4.293 de	10.38 b	11.14 de
	Nitrobein + Protamine	4.037 cd	4.483 cd	10.60 b	11.36 d
	Protamine	3.597 e	4.043 e	10.61 b	11.37 d
Fish scrap	Nitrobein	4.430 b	4.877 b	11.86 ab	12.63 a
	Nitrobein + Protamine	4.810 a	5.257 a	12.01 ab	12.78 a
	Protamine	4.160 c	4.607 c	11.81 ab	12.58 a
Control		3.033 f	3.480 f	9.483 b	10.25 g

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test.

Table 5. The interaction effect between organic fertilizer sources and biofertilizers Nitrobein + Protamine on shoot length, No. of leaves/shoot and leaf area of "Kalamata" olive trees during 2015 and 2016 seasons.

Treatment		Shoot length (cm)		No. of Leaves/ Shoot		Leaf area (cm^2)	
		2015	2016	2015	2016	2015	2016
Goat manure	**Nitrobein**	26.87cde	21.60 e	27.80 cd	18.00 bc	3.543 k	4.863ab
	Nitrobein + Protamine	25.05def	22.90 cd	29.47 bc	20.97 a	4.453 e	5.400 ab
	Protamine	22.23 fg	22.60 de	26.60 d	18.73 abc	4.040 h	5.497 ab
Olive pomace	**Nitrobein**	17.07 i	23.83 bc	23.20 e	19.85 ab	4.243 g	3.910 cd
	Nitrobein + Protamine	20.80 g	23.13 cd	21.27 ef	18.72 abc	4.003 i	4.410 c
	Protamine	23.32 fg	21.73 e	20.02 f	19.73 ab	3.973 j	5.320abc
Chicken manure	**Nitrobein**	29.58 bc	19.44 f	21.20 ef	19.87 ab	4.993 a	5.740 a
	Nitrobein + Protamine	28.13cd	23.38 cd	28.33bcd	18.87 abc	4.533 d	3.553 de
	Protamine	20.47gh	23.81 bc	21.33 ef	15.93 c	4.933 b	5.043 b
Fish scrap	**Nitrobein**	38.40 a	25.00 a	32.80 a	20.60 a	4.533 d	5.663 a
	Nitrobein + Protamine	32.13 b	22.27 de	29.93bc	19.10 ab	4.723 c	3.820 cde
	Protamine	24.67 ef	24.57 ab	30.60ab	20.07 a	4.263 f	4.697 c
Control		17.50 hi	14.00 g	18.77 f	15. 76 c	2.243 l	2.897 e

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test.

Table 6. The interaction effect between organic fertilizer sources and biofertilizers Nitrobein + Protamine on leaf pigments content of "Kalamata" olive trees during 2015 and 2016 seasons.

Treatment		Chlorophyll A (mg.100 g f.w)		Chlorophyll B (mg.100 g f.w)		Carotenoids (mg.100 g f.w)	
		2015	2016	2015	2016	2015	2016
Goat manure	**Nitrobein**	12.24 j	15.24abcd	7.823 b	6.990 c	1.227 k	1.687 bc
	Nitrobein + Protamine	12.99 g	15.02abcd	7.313 e	6.563 c	1.487 j	1.727 abc
	Protamine	12.55 h	16.32 abc	7.713 c	7.853 b	1.187 m	1.867 a
Olive pomace	**Nitrobein**	11.32 l	13.64 bcd	5.593 l	6.860 c	3.107 c	1.820 ab
	Nitrobein + Protamine	12.10 k	12.03 d	5.903 h	5.400 ef	3.297 a	1.853 a
	Protamine	12.44 i	13.70 bcd	5.703 k	5.640 de	3.147 b	1.533 d
Chicken manure	**Nitrobein**	14.21 f	12.66 cd	5.893 i	5.327 ef	2.427 h	1.460 d
	Nitrobein + Protamine	14.48 e	13.23 bcd	5.813 j	4.777 ef	2.717 e	1.433 d
	Protamine	14.72 d	17.05 ab	6.143 g	6.423 cd	2.367 i	1.020 f
Fish scrap	**Nitrobein**	17.33 b	14.31 bcd	7.383 d	5.200 ef	2.467 g	1.453 d
	Nitrobein + Protamine	17.08 c	16.25 abc	6.863 f	7.960 b	2.697 f	1.670 c
	Protamine	17.64 a	18.84 a	8.103 a	8.787 a	2.977 d	1.193 e
Control		11.20 m	12.26 d	5.393 m	4.647 f	1.207 l	0.590 g

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test.

Chlorophyll b was significantly increased due to adding fish scrap with Protamine treatments in both seasons. While, the control treatment had the least value in this respect. Olive pomace with Nitrobein + Protamine caused a high significant increase in carotenoid in first season. While, the goat manure with Protamine or olive pomace with Nitrobein + Protamine treatments gave the highest value in second season. While, the control had the least value in this respect. The other interactions came in between.

These results go in line with those reported by **El-Deeb (2003a)** they conclude that the chlorophyll A and B of 'Manzanillo' olive trees were remarkably increased with fish scrap fertilizer applied in tranches and supported with biofertilizer.

Leaf Mineral Contents

As shown in Table 7, the tested treatments had significant effect on leaf mineral contents in both seasons. The nitrogen content was increased by adding fish scrap with Protamine (2.050 and 2.060 %) in both seasons compared to other interactions. The highest content of leaf phosphorus content (0.188 and 0.184%) was noticed due to fish scrap with Nitrobein+Protamine application in both seasons, respectively. In the meantime, the least values were noticed by fish scrap with Protamine in the first season and fish scrap with Nitrobein in the second season, respectively. The other interactions revealed in between effect.

The highest value of potassium content were noticed by goat manure with Nitrobein (2.140 and 2.160%) in both seasons, respectively. While, the least values were given by chicken manure with Protamine (1.780 and 1.760%) in both seasons, respectively. These results were in the same line of **El-Deeb (2003b)** who found that leaf N, P, K, Ca, Mg, Fe, Mn and Zn content were enhanced with fish scrape fertilizer or olive pomace applied in trenches and provided with Rhizobacterein.

Presented data in Table 8 show that the effect of fertilization treatments had significant effect on leaf mineral contents (Ca%, Mg% and Fe ppm) in the two seasons of study.

The highest calcium content was noticed by fish scrap with all biofertilizers treatments in the two season. While, the least values were given by using goat manure with Nitrobein in both seasons.

Magnesium content was significantly increased by the fish scrap with Nitrobein + Protamine application (0.211 and 0.209%), which induced more simulative effect on magnesium content in both season, while, control had the least value in both seasons. The other interactions came in between.

Respecting, the interaction effect between organic fertilizer sources and biofertilizers N-fixing bacteria as well as amino acid. The results in Table 8 illustrate that the highest number of Fe (19.31 and 19.27 ppm) content was noticed by adding goat manure with Protamine in both seasons, respectively. While, the least values were given by chicken manure with Nitrobein + Protamine in both seasons. The other interactions revealed in between effect.

Generally, it can be concluded that addition of organic fertilizer to soil was efficient in supplying the nutritional requirements of olive trees of each Nntrogen, phosphor and potassium and that reflected on tree growth and productivity, that could be attributed to the role of NPK. Hence N is found in many important compounds including amino acids, proteins, enzymes, nucleic acids and chlorophyll. Also, P is the key factor in compounds that store, transfer and utilize energy in plants. It is also building blocks for DNA. However, K plays an important role in maintaining cell turgid and in the opening of stomata **(Johnson and Phene, 2008).** Organic fertilizers improved peach leaf mineral content **(Fayed, 2005; Bahaa, 2007).** Moreover,

Table 7. The interaction effect between organic fertilizer sources and biofertilizers Nitrobein and Protamine on leaf mineral contents (N, P and K) of "Kalamata" olive trees during 2015 and 2016 seasons.

Treatment		N content (%)		P content (%)		K content (%)	
		2015	2016	2015	2016	2025	2016
Goat manure	Nitrobein	1.720 ef	1.760 ef	0.169 d	0.168 e	2.140 a	2.160 a
	Nitrobein + Protamine	1.810 d	1.580 g	0.181 b	0.179 b	1.980 e	1.970 f
	Protamine	1.650 f	1.630 fg	0.168 e	0.166 f	1.960 g	1.940 h
Olive pomace	Nitrobein	1.880 bcd	1.870 cd	0.153 h	0.155 i	2.030 d	2.050 d
	Nitrobein + Protamine	1.790 de	1.810 e	0.175 c	0.178 c	1.930 i	1.930 i
	Protamine	1.760 def	1.730 efg	0.147 i	0.149 j	2.100 c	2.080 c
Chicken manure	Nitrobein	1.860 cd	1.840 de	0.153 h	0.155 i	2.130 b	2.150 b
	Nitrobein + Protamine	1.970 abc	1.980 b	0.164 f	0.163 g	1.960 g	1.980 e
	Protamine	2.040 ab	2.010 ab	0.154 g	0.156 h	1.780 k	1.760 k
Fish scrap	Nitrobein	1.980 ab	1.940 bc	0.164 f	0.148 k	2.130 b	2.150 b
	Nitrobein + Protamine	1.940 bc	1.920 c	0.188 a	0.184 a	1.860 j	1.880 j
	Protamine	2.050 a	2.060 a	0.127 j	0.175 d	1.950 h	1.970 f
Control		1.880 bcd	1.850 cde	0.164 f	0.166 f	1.970 f	1.950 g

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test.

Table 8. The interaction effect between organic fertilizer sources and biofertilizers Nitrobein and Protamine on leaf mineral contents (Ca, Mg and Fe) content of "Kalamata" olive trees during 2015 and 2016 seasons.

Treatment		Ca content (%)		Mg content (%)		Fe content (ppm)	
		2015	2016	2015	2016	2015	2016
Goat manure	Nitrobein	0.461 d	0.491 k	0.183 g	0.185 f	17.06 d	17.40 c
	Nitrobein + Protamine	0.609 ab	0.605 abc	0.178 h	0.179 g	16.25 i	16.23 h
	Protamine	0.489 bcd	0.608 abc	0.186 f	0.185 f	19.31 a	19.27 a
Olive pomace	Nitrobein	0.513 a-d	0.515 c	0.197 d	0.198 d	10.93 k	10.95 k
	Nitrobein + Protamine	0.523 a-d	0.526 c	0.201 c	0.204 c	10.55 l	10.52 l
	Protamine	0.516 a-d	0.514 c	0.194 e	0.196 e	17.31 c	17.29 d
Chicken manure	Nitrobein	0.4680 d	0.466 d	0.165 l	0.167 i	16.48 g	16.51 f
	Nitrobein + Protamine	0.4760 cd	0.479 d	0.171 j	0.173 h	10.36 m	10.33 m
	Protamine	0.6030 ab	0.606 abc	0.168 k	0.166 j	11.65 j	11.67 j
Fish scrap	Nitrobein	0.6140 a	0.613 ab	0.177 i	0.179 g	17.82 b	17.84 b
	Nitrobein + Protamine	0.6270 a	0.625 a	0.211 a	0.209 a	16.76 e	16.75 e
	Protamine	0.6190 a	0.622 a	0.206 b	0.205 b	16.65 f	11.68 i
Control		0.597 abc	0.596 bc	0.159 m	0.151 k	16.31 h	16.29 g

Means followed by the same letter(s) within each column are not significantly different at the 0.05 level, according to Duncan's multiple range test.

the organic fertilizer contains high organic matter and high macro and micro nutrients which help to improve soil physical and chemical characteristics **(Vogtman and Fricke, 1989).** Also, these effects could be due to that a set of soil microorganism processing the ability and mobilizing the unavailable forms of nutrient elements to be available for absorption by roots **(Fawzi *et al.*, 2010).**

REFERENCES

Arnon, D.I. (1949). Copper enzymes in isolated chloroplasts polyphenoloxidase in Beta vulgaris, L. Plant Physiol., (24): 1-5.

Bahaa, M.S. (2007). Organic and Bio-fertilization of Peach Trees. M.Sc. Thesis, Fac. Agric, Cairo Univ., Egypt, 101.

Bevacqua, R.F. and Mellano, V.J. (1993). Sewage sludge compost accumulative effects on crop growth and soil properties. Compost Sci. Util., (1): 34-37.

Bremner, D.C. and Mulvaney, J.M. (1982). Total Nitrogen. In: Methods of Soil Analysis. (A.L. Page, R.H. Miller and D.R. Keaney, eds). Am. Soc. Agron., No.9 part 2.

Brown, J.D. and Lilliland, O. (1946). Rapid determination of potassium and sodium in plant material and soil extracts by flamephotometery. Proc. Amer. Soc. Hort. Sci. (48): 341-346.

Claudio, C.; Antonio, C. and Graziano, S. (1999). Morphological evaluation of olive germplasm present in Tuscany region Euphytica., 109: 173–181.

Duncan, B.D. (1955). Multiple Range and Multiple F-tests. Biomet., (11): 1- 42.

El-Deeb, M.D. (2003a). The use of some organic and bio-fertilizers for 'Manzanillo' olive trees fertilization. A. tree growth and leaf mineral content. Agric. Res. J. Suez Canal Univ., 2 (1): 33-42.

El-Deeb, M.D. (2003b). The use of some organic and bio-fertilizers for 'Manzanillo' olive trees fertilization. B. Fruiting and fruit quality. Agric. Rese. J., Suez Canal Univ., 2 (1): 43-52.

Fawzi, M.I.; Shahin, F.M.; Elham, D.A. and Kandil, E.A. (2010). Effect of organic and biofertilizers and magnesium sulphate on growth yield, chemical composition and fruit quality of "Le-Conte" pear trees. Nat. and Sci., 8 (12): 273-280.

Fayed, T.A. (2005). Effect of some organic manures and biofertilizers on 'Anna' apple trees. 2-Yield and fruit characteristics. Egypt. J. App. Sci., 20 (1): 176-191.

GOAEF (1999). General Organization for Agriculture Equalization Fund. Ministry of Agric. Biogen, phosphorien, nitrobien and potassien bulletins.

Haggag, Laila, F.; Shahin, M.F.M.; Mustafa, N.S.; Mahdy, H.A. and Hassan, H.S.A. (2015). Studies on the effect of vinasse, amino acids and humic acid substances as soil applications on fruit quality and quantity of 'Manzanillo' olive trees. Mid. East J. Appl., (5): 984-991.

Jackson, M.L. (1958). Soil Chemical Analysis. Prentice Hall Inc. Englewood Cliffs, NJ, USA.

Johnson, R.S. and Phene, B.C. (2008). Quality disorders in an early maturing peach cultivar caused by postharvest water. Acta Hort., 792: 385-390.

Ministry of Agriculture and Land Reclamation, Egypt (2016). Statistical data.

Mosa, W.F.A.; Paszt, L.S. and Abd El-Megeed, N.A. (2014). The role of Bio-Fertilization in improving fruits productivity-A Review. Adv. in Microbiol., (4): 1057-1064.

Piper, C.S. (1947). Soil and plant analysis. Univ. Adelaide (Australia), 59-74.

Russell, D.F. (1986). MSTATC Director, Crop and Soil Sci. Dept., Michigan State Univ., Computer Program Package Version 2.10.

Usman, M. (2015). Cow dung, goat and poultry manure and their effects on the average yields and growth parameters of tomato crop. J. Biol., Agri. and Healthcare. Vol.5 (5):7-11.

Vogtman, H. and Fricke, K. (1989). Nutrient value and utilization of biogenic composts in plant production. Agric. Ecosyst. Environ., 27: 471-475.

Wensttein, D. (1958). Chlorophyll-letale and Der supuni kroa kapisene jor winneck sec. Der. Plastiden, Exp. Cell Res., 12: 472.

Yousef, Aml R.M.; Mostafa, E.A.M. and Saleh, M.M.S. (2011a). Response of olive seedlings to foliar sprays with amino acids and some micro elements. Agric. and Biol. J. North Ame., (7): 1108 -1112.

Yousef, Aml, R.M.; Emam, Hala, S. and Saleh, M.M.S. (2011b). Olive seedlings growth as affected by humic and amino acids, macro and trace elements applications. Agric. and Biol. J. North Ame., 2 (7): 1101 - 1107.

الملخص العربى

تأثير التسميد الحيوي والعضوي علي النمو الخضري والمحتوي المعدني لأوراق أشجار الزيتون الكالاماتا تحت ظروف شمال سيناء

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أجريت الدراسة خلال عامي ٢٠١٥ و٢٠١٦ في المزرعة التجريبية بكلية العلوم الزراعية البيئية - جامعة العريش، محافظة شمال سيناء، مصر على أشجار الزيتون صنف كلاماتا عمر ١٠ سنوات، والمنزرعة في تربة رملية طمييه على مسافات ٦ × ٧ م تحت نظام الري بالتنقيط، وتم دراسة التأثير وتداخل الفعل لكل من: مصادر مختلفة من التسميد العضوي (مسحوق الأسماك بمعدل ٢,٥ كيلوجرام للشجرة، وزبل الماعز بمعدل ١٦,٨ كيلوجرام للشجرة، وسبلة الدواجن بمعدل ٧,٨ كيلوجرام للشجرة، وتفل الزيتون بمعدل ٨,٥ كيلو جرام للشجرة) في خنادق ارضية في شهر ديسمبر من كل عام، كما تم دراسة تأثير التسميد الحيوي بمثبت نيتروجيني النيتروبين بمعدل ١٥٠ جرام للشجرة الواحدة والحمض الأميني البروتامين " بتركيز ١,٥% منفردين أو كلاهما معاً، وتمت الإضافة أرضيا على ثلاث دفعات الأولى عند ٧٠% من الإزهار الكامل والثانية بعد العقد والثالثة بعد شهر من الإضافة الثانية، طبقاً للنتائج المتحصل عليها في هذه الدراسة فإنه يمكن التوصية باستخدام التسميد العضوي خاصة مسحوق الأسماك من خلال إضافة التسميد الحيوي مستخدماً النيتروبين مع الحمض الأميني البروتامين بتركيز ١,٥% مجتمعين حيث أدت هذه المعاملة إلى تحسين النمو الخضري والمحتوى المعدني لأوراق الزيتون مع إنتاج محصول عال بالإضافة للمحافظة على البيئة من مشاكل التلوث الناشئ عن التسميد المعدني وكذلك استخدام المخلفات البيئية.

الكلمات الاسترشادية: التسميد العضوي، التسميد الحيوي، الكالاماتا، مسحوق السمك، النمو الخضري، المحتوي المعدني.

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