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Effect of Mineral, Bio-NPK Soil Application of Young Olive Trees and Foliar Fertilization on Leaf and Shoot Chemical Composition

Osman, S. M.

Desert Research Center, Cairo, Egypt.

Abstract: The present study was carried out on one year -old two olive cultivars, Coronaiki as oil cultivar and Manzanillo as double purpose (table and oil) cv. in a private farm located at western desert along Cairo, Alexandria Road (50 km from Cairo), Egypt and planted at 5 x 6 meter apart in sandy soil and irrigated with drip irrigation system trees were similar in growth vigour and received the common horticultural practices. The main objectives of the research was studying the effect of mineral and Bio-NPK soil application on leaf and shoot chemical composition. Results indicated that Manzanillo leaves were the richest in chlorophyll A&B and the poorest in Caratenoids, while the reverse was true in Coronaiki leaves during the two seasons of study. On the other side, Coronaiki cultivar had the richest leaves and exceeded statistically the Manzanillo olive cultivar regarding leaf, N; P; K; Ca, Mg; Fe; Mn and Zn contents from one hand, but the poorest leaves of least value of Cu content from the other hand. Coronaiki plants were statistically the richest in both shoot nitrogen and total carbohydrates contents as well as C/N ratio while the reverse was found with Manzanillo young trees. The obtained results revealed that, bio -NPK fertilizer treatments soil applied significantly increased all leaf amino acid content and mineral composition, shoot nitrogen and total carbohydrates as well as C/N ratio contents increased by T6 (Kotengin + Biofertilizer + K_2SO_4) soil applied solely which were the superior in this respect.

Key words: Coronaiki olive, Manzanillo olive, fertilization, Biofertilizer, kotengin, chlorophyll, carotene, amino acids, carbohydrates, leaf mineral content.

INTRODUCTION

Olive tree (*Olea europaea* L.) belongs to the family Oleaceae. It can thrive and produce in new reclaimed areas where other crops can't grow. Beside, the nutritional importance of olive fruits, either as a table or for oil production. Hence, olive areas increased rapidly in Egypt and reached about 117886 feddans, which in turn produced about 336442 metric tons of fruits in the 2003 year according to the statistics of Ministry of Agriculture and Land Reclamation vol. (2). Although olive trees can survive and grow under low soil fertility and water availability conditions, many research studies have been indicating that improving soil fertility and satisfying water requirement are essential factors to obtain a high production. However, increasing olive tree productivity under desert conditions must be based on appropriate technical and economic management to the natural resources scarcity. Biofertilization are biological preparations containing primarily patent strains of micro- organisms in sufficient numbers. These micro- organisms have definite beneficial roles in the fertility of soil rhizosphere and the growth of seedlings. The multi-strain biofertilizers might contain different strains of symbiotic associative diazatrophes, phosphate-solubilizing micro- organisms, silicate dissolving micro-organisms, blue green algae and VAM, Saber,[1]. Biofertilizers proved to eliminate the use of pesticides sometimes, and rebalance the ratio between plant nutrients in soils. They are easy and safe to handle with field applications improved their efficiency in increasing crop yields and decreasing the costs of some agricultural practices. It is worthy to state that biofertilizers do not replace mineral fertilizers, but significantly reduce their rate of application, Saber,[2]. A variety of biofertilizers are now available commercially. Specific strains are used as biological fertilizers, for nitrogen, phosphorus and silicate dissolving such as N-fixing bacteria and yeasts. The use of these materials encourages yield and keeps the environment clean.

The present study aimed to throw some light on the beneficial effect of soil application with N, P & K as well as some biofertilizers namely, phosphorene, Rizobacterin, and Kotengin on growth and nutritional status of young olive trees grown in sandy soil. The direct effect of some biological treatments on olive seedlings was reported by, Khamis *et al*.,[3,4] and Abd El-Aziz,[5].

Corresponding Author: Osman, S.M., Desert Research Center, Cairo, Egypt.

MATERIALS AND METHODS

This study was conducted during two successive seasons, 2003 and 2004 in a private farm located at western desert along Cairo Alexandria road, 50 km from Cairo, Egypt of olive cultivars (Olea europea L.). The study was conducted on two olive cultivars (*Olea europea* L., Coronaiki as oil cultivar and Manzanillo., as a double purpose (table and oil). Juvenile young trees (one year old) of two olive cultivars grown on their own roots; planted at 5 x 6 meter apart in sandy soil in a private orchard under drip irrigation system using underground (well) water resource pumped from a depth of 70 m plants were carefully selected for being uniform in their growth vigour and devoted as plant materials in this regard.

Before experiments had been conducted in 1st season, mechanical and chemical analysis of orchard soil from the successive depth of two profiles: (0: 30 cm), (30–60 cm) and irrigation water were determined according to the methods described by Piper,[6] and Jackson,[7] as shown in Table (1 & 2).

The biofertilizer (BF) which used in this study were produced by soil microbiology unit, desert research center, it was applied with a concentration of 1 × 108 CFm, a multi strains of Azotobacter Chroococcum ASW 35, Azotobacter.

Rizobacterin application as an additional N biofertilization, while phosphorene additional P-Biofertilization additional micro and macro elements biofertilization to the trees.

The olive orchard was fertilized with 15m3 cattle manure per feddan and 2.5 Kg. of superphosphate per tree was added also 1.75 Kg. of potassium sulphate per tree was added as soil application at the 1st week of December. nitrogen fertilizer was added of the recommended rate (5 Kg. of ammonium sulphate per tree) divided to three doses at January, June and August . Thus, the field experiment was conducted as follows :

1. Control (*)
2- Soil application of kotengin + $(NH4)_2SO_4$ at 150 g/tree + P2o5 at 150 g/tree + K_2SO_4 at 150 g/tree.
3- Soil application of kotengin + (NH4)2 so4 at 150 g/tree + phosphorene + K_2SO_4.
4- Soil application of kotengin + phosphorene + Rhizobacterin + K_2SO_4.
5- Soil application of kotengin + Super Phosphate+Rhizobacterin + K_2SO_4.
6- Soil application of kotengin + Biofertilizer + K_2SO_4.

Taking into consideration that ammonium sulphate, super phosphate and potassium sulphate as N; P and K fertilizers each at 150 g/ tree was fractionated to be soil added at March, May and July for the corresponding treatment. However, Kotengin at 80 g/tree phosphorene and Rhizobacterin at 400 g/tree, Biofertilizer at 1 L/24 liters water was added to wetted soil, applied once a year in 1st two seasons at February for each treated plant.

The complete randomized block design with three replications was used for arranging the differential investigated treatments (combinations between 2 olive cvs. and different mineral / bio- fertilizers) included in each of the aforesaid experiment. Every replicate was represented by two trees. The response of two olive cultivars to the differential treatments of the aforesaid experiment was investigated through determining the following measurements.

Chemical Analysis:

1- Photosynthetic Pigments (Chlorophyll A, B and Carotene): Chlorophylls a, b and carotene contents in mature leaves in response to different treatments in both seasons were determined, where leaf samples (20 mature fresh leaves from spring growth cycle) were selected from the middle of each new shoot and taken at the 1st week of October according to Saric *et al.,*[9]. Fresh samples (0.5 gm) from each replicate were homogenized with acetone (88% V: V) in the presence of little amount of $Na_2 CO_3$ and silica quartz, then filtered through central glass funnel G4. The residue was washed several times with acetone until the filtrate became colourless. The combined extract was completed to a known volume for the calorimetric determination at wave length of 662, 644 and 440.5nm to determine chlorophyll a, b, and carotenoids, respectively, then concentrations of each component was calculated as follows:

Chlorophyll “a” = (9.784 ´ E662) – (0.99 ´ E644) = mg/L.

Chlorophyll “b” = 21.426 ´ E644) – (4.65 ´ E662) = mg/L.

Carotene= (4.695´E440.5) – 0.268 (Chl. “a” + Chl. “b”) = mg/l.

E = optical density at a given wave length .

2- Total free Amino Acids as mg/100g F.W.: Total free amino acids were determined according to the photometric Ninhydrin method of Moore and Stein,[10]. The blue color produced by Ninhydrine reaction at 100°C was determined by colorimeter at 570 mm where alanine was used for calculation of total amino acids content.

3- Leaf Minerals Determination: Representative samples of the fourth and fifth leaves from the base of spring shoots were collected from each replicate in October during both seasons. The samples were thoroughly washed with tap water, rinsed twice with distilled water and oven dried at 70°C till a constant weight and finally ground for determination of:

a) Total nitrogen by the semi – micro – kjeldahl method as outlined by Pregl,[11].
b) Phosphorus estimated according to the method described by (Murphy and Riely,[12] using speklo spectrophomoter at 88.2 Uv.
c) Potassium was estimated by the flame spectrophotometer methods recommended by (Brown and Lilleland,[13].
d) Calcium, Magnesium, iron, Manganese, Zinc and copper were determined using the Atomic absorption spectrophotometer "Perkin Elmer -3300" after Chapman and Pratt,[14].

4- Total Carbohydrates Content: Dried samples of one year old shoots (0.20 gm) of each replicate were acid hydrolyzed for six hours in boiling water bath using , N H_2SO_4.

Total carbohydrates were assayed using the phenol sulfuric acid method Smith *et al.,*[15] and calculated as gram glucose per 100 grams dry weight.

5- Shoot Total Nitrogen Content and C/N ratio: Shoot nitrogen content was determined by micro – kjeldahl method as mentioned before Pregl,[11] and C/N ratio was calculated.

All data of the present investigation were subjected to analysis of variance and significant differences among means were determined according to Snedecor and Cochran,[16]. In addition; significant differences among means were distinguished according to the Duncan's , multiple test range, Duncan,[17], where capital and small letters were used for differentiating the values of specific and interaction effects of the investigated factors, respectively.

RESULTS AND DISCUTION

A. Photosynthetic Pigments (Foliar Pigments): Leaf chlorophyll (A&B) and carotenes contents of olive young trees in response to specific and interaction effects of two studied factors of experiment were investigated.

Data obtained during both 2003 and 2004 experimental seasons are presented in Tables (3).

1. Leaf chlorophyll A & B contents: Data obtained in Table (3) showed obviously a variable response during the two seasons. 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 from 1st experiment soil applied treatment. The highest values of chlorophyll (A & B) contents were detected in Coronaiki cvs. Fertilized with NPK foliar spray treatment which showed a relative the highest values of both chlorophyll A and B contents as compared to water spray (control) treatment which exhibited statistically the lowest values during 2003 and 2004 experimental seasons. Other combinations are in between the aforesaid two extremes.

The previous results are agree with early findings of Jackson and Volk,[18] that potassium is required for development of chlorophyll "A" and activated enzyme reactions involved in chlorophyll "A" synthesis Weaver, [19]. The increase in chlorophyll "B" may be due to the increase in chlorophyll "A" because chlorophyll "A" is a precursor for the synthesis of chlorophyll "B" Smith and French,[20], Castelfranco and Beale,[21] Moreover, Aly,[22] found that all treatments of soil nutrients N, P, K, Mg & EM) increased the leaf chlorophyll "A" and "carotene" Contents, whereas, both levels of added potassium and magnesium gave the highest values. Concerning to chlorophyll "B" content there were no significant differences among treatments .

2. Leaf Carotenes Content: Table (3) showed that carotein of all fertilized olive trees with bio-NPK fertilizer were significantly increased as compared with the control during the study. The highest level of leaf carotein content was always in closed relationship to such combination representing. Coronaiki olive trees fertilized with Biomagic foliar spray + T6 from 1st experiment soil applied (Kotengin + biofertilizer+ K_2SO_4). On the other hand, the lowest increase in leaves carotein content over the control was exhibited by Manzanillo olive trees fertilized with NPK foliar spray during the two seasons of study. In addition, other combinations are in between the aforesaid two extremes. Hasan,[23] found that leaf carotenoids content was generally the richest in Coronaiki transplants followed in a descending order by those of Aggizi and Manzanillo cvs.

3. Leaf Total Free Amino Acids Contents: Table (3) showed obviously the variable response of olive trees to the different combinations used during the two seasons. The highest values of leaf free amino acids were detected by the combination between Manzanillo trees fertilized with the Biomagic foliar spray + the T6 in 1st experiment (Kotengin + biofertilizer + K2So4 soil applied) treatment. However the lowest increase values of leaf total free amino acids content were detected by Coronaiki olive trees received NPK foliar spray treatments during the two seasons of study. Moreover other combinations were in between the aforesaid two extremes.

This result are in agreement with the findings of Hasan,[23] who found that leaves of Aggizi transplants were the richest followed by Manzanillo, while Coronaiki was the poorest leaves. Differences were signficnant for a given cultivar when compared to the analogous ones of the two other ones.

B. Leaf Mineral Cntents:

1. Leaf Nitrogen Content: Table (4) showed obviously that the most increase effect was observed with the combination between Coronaiki trees x Biomagic foliar spray + T6 in 1st experiment soil applied (Kotengin + biofertilzer + K2So4) during the two seasons of study. Moreover, the lowest value of increase in leaf– N content over control (tap water spray) was detected by Manzanillo trees fertilized with NPK foliar spray. On the other hand, other combinations were in between in this concern.

These results are similar to those obtained by Hasan,[23] who stated that Coronaiki olive cultivar exceeded regarding leaf- N content as compared with Manzanillo and Aghizi olive transplants. Moreover, Girgis,[24] found that, olive cultivars, can be arranged in its leaf nitrogen content in a descending order, Picual, Aggizi, Manzanillo and Coronaiki olive trees. While, Abd El-Hameed,[25] found that the interaction between 100% N and BF + BS recorded the highest significant leaf content of N.

In parallel to these findings, Sharaf *et al.,*[26]; Khamis *et al.,*[4]; Abbas,[27] and Emtithal *et al.,*[28] stated that adding nitrogen and / or potassium increased leaf nitrogen content.

2. Leaf Phosphorus Content: Results in Table (4) showed that leaf- P content exhibited significantly the highest levels by such combination between Coronaiki cvs x both Biomagic and Nofaterin each solely foliar sprays or combined with the T6 or T4 in 1st experiment of soil applied treatments. On the contrary, Manzanillo cv x tap water foliar spray (control) treatment has the lowest leaf- P value during the two seasons of study. Other combinations were in between the aforesaid two extremes. In this respect, Abd El-Hameed[25] found that the interaction between 100 % N and BF + BS gave the highest significant leaf content of P.

3. Leaf Potassium Content: Table (4) showed obviously the significant variances in this concern, during 2003 and 2004 seasons. The most increasing effect on leaf- K content was detected by the combination between Coronaiki olive trees fertilized with Biomagic foliar spray + the T6 in 1st experiment treatments, where the highest increase was resulted. Moreover, the least increase in leaf- K content over control was detected by Manzanillo olive trees received the NPK solution foliar spray treatment during 1st and 2nd seasons. Other combinations were in between.

In this respect, Abd El-Hameed,[25] found that the interaction between 100% N and BF+ BS gave the highest significant leaf content of K.

4. Leaf Calcium Content: Table (4) showed obviously the variable response of olive trees to the different combinations used during the two seasons of study. The higher increase leaf- in Ca% was detected by the combinations between Coronaiki olive trees x Nofaterin foliar spray treatment, while the lowest increase in leaf- Ca content was detected by Manzanillo olive trees fertilized with Biomagic foliar spray + T6 from 1st experiment soil applied as compared to those sprayed with tap water (control) during both 2003 and 2004 experimental seasons. Other combinations were in between the above-mentioned two extents.

These results are similar to those obtained by Girigs,[24] who found that Coronaiki olive cv. has the highest value of leaf- Ca content during the growing seasons. Reversely, Manzanillo has the least significant in both seasons. In addition, Hasan,[23] showed that Aggizi olive leaves had statistically the highest value of leaf- Ca content, while the reverse was true with Coronaiki transplants during both seasons.

5. Leaf Iron Content: Table (5) revealed that different combinations of the two investigated factors can act together in affecting Fe level in olive leaves during 2003 and 2004 experimental seasons. In addition, pattern of Fe distribution showed that leaves of Coronaiki trees fertilized with Biomagic foliar spray + the T6 in 1st experiment had the highest value of leaf- Fe content when compared with plants sprayed with water (control) during the two seasons of study. On the other hand, the least increase in leaf- Fe content was detected by Manzanillo plants fertilized with NPK solution foliar spray as compared with control (water spray) during 1st and 2nd seasons. Other combinations were in between the aforesaid two extremes. These was agreed with the findings of Abd El-Hameed,[25] who mentioned that the interaction between 100% N and BF + BS gave the highest significant leaf- Fe content of Manzanillo olive trees.

6. Leaf Manganese Content: Table (5) showed obviously a variable response during 2003 and 2004 experimental seasons.

Herein, the highest value of leaf- Mn content was detected by the combination between the Coronaiki olive trees fertilized with Biomagic foliar spray + T6 in 1st experiment (Kotengin + Biofertilizer + K2So4) soil applied treatment while the reverse was true in the Manzanillo cv trees treated with tap water foliar spray (control) treatment. Other combinations were in between the aforesaid two extremes. In this respect, Abd El-Hameed,[25] reported that the interaction between 100% N and BF+ BS gave the highest significant leaf content of Mn.

Table 1: Chemical Analysis of orchard Soil from the successive depth of two profiles: (0:30 cm), (30–60 cm).

Depth (cm)	Ec mmhos/ cm	PH	O.C. %	O.M. %	Total N ppm	C/N Ratio	Cations mg/ L					Anions mg/ L		
							Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3--	HCO_3-	Cl-	SO_4--
0-30	36.0	7.95	0.098	0.169	126	7.78	56.5	64.3	233	1.1	-	32.5	226.5	95.9
30-60	22.3	7.93	0.12	0.206	189	6.35	31	29.6	158.9	0.8	-	24.2	146	50.1

Table 2: Physical Analysis of orchard Soil from the successive depths of two profiles: (0:30cm), (30–60 cm).

Depth (cm)	CaCO3 %	Gravel %	Coarse sand %	Total sand %	Fine sand %	Silt %	Clay %	Soil texture
0-30	3.2	31.9	23.2	44.4	67.6	0.5	-	Gravel sand
30-60	3.3	32	24.4	39.7	64.1	3.6	0.3	Gravel sand

Chroococcum ED 21, Azospirillum Brasilense ASW 14, Azospirillum Brasilense Rs 17 and Bacillus Megatherium LCS. 38.

Table 3: Specific and Interaction effects of olive cultivars, some bio- mineral NPK fertilizers soil applied and their combinations on leaf Chlorophyll (A) and (B) contents, Carotene content (mg/100 gm. F.W) and Total free amino acids (mg/ 100 d.w) during both 2003 and 2004 experimental seasons.

	Chlorophyll (A) content (mg/100 gm. F.W)			Chlorophyll (B) content (mg/100 gm. F.W)			Carotene content (mg/100 gm. F.W).			Total free amino acid (100 g. F.W.).		
Treatments	M	C	Mean**	M	C	Mean**	M	C	Mean**	M	C	Mean**
						2003 season						
(T1) Control	1.04 g	0.83 j	0.93 F	0.45 gh	0.36 j	0.41 D	0.33 h	0.41 ef	0.37 D	1.19 i	1.10 j	1.15 F
(T2) NPK	1.24 d	1.00 h	1.12 D	0.55 c	0.43 hi	0.49 BC	0.40 f	0.50 b	0.45 B	1.37 f	1.27 h	1.32 E
(T3) Kotengin+ Phosphorene + (NH4)2 SO4+K2SO4	1.38 b	1.10 f	1.24 B	0.61 ab	0.48 ef	0.55 A	0.43 ce	0.55 g	0.49 AB	1.44 d	1.33 g	1.39 D
(T4) Kotengin+ Phosphorene + Rhizo- bacterin +K2SO4	1.16e	0.93i	1.05E	0.52d	0.41 i	0.46 C	0.37 g	0.46 c	0.41 C	1.58 b	1.47 d	1.53 B
(T5) Kotengin+ P+ Rhizo- bacterin +K2SO4	1.33 c	1.06 g	1.20 C	0.58 b	0.46 fg	0.52 AB	0.42 df	0.53 a	0.48 AB	1.51 c	1.40 e	1.46 C
(T6) Kotengin+ Biofertilizer+ K2SO4	1.43 a	1.15 e	1.29 A	0.62 a	0.50 de	0.56 A	0.44 cd	0.56 a	0.50 A	1.64 a	1.52 c	1.58 A
Mean*	1.26 A	1.01 B		0.56 A	0.44 B		0.40 B	0.50 A		1.46 A	1.35 B	
						2004 season						
(T1) Control	1.33 h	1.06 k	1.93 E	0.61 f	0.49 i	0.55 E	0.37 i	0.46 fg	0.42 D	1.22 i	1.13 j	1.17 F
(T2) NPK	1.59 d	1.27 i	1.43 D	0.73 c	0.58 g	0.66 C	0.45 f	0.57 c	0.51 B	1.40 f	1.30 h	1.35 E
(T3) Kotengin+ Phosphorene + (NH4)2 SO4+K2SO4	1.76 b	1.41 ef	1.59 B	0.81 a	0.65 e	0.73 AB	0.50 de	0.62 ab	0.56 A	1.47 d	1.36 g	1.42 D
(T4) Kotengin+ Phosphorene + Rhizo- bacterin +K2SO4	1.49 e	1.19 j	1.34 E	0.69 d	0.55 h	0.62 D	0.42 h	0.52 d	0.47 C	1.62 b	1.50 d	1.56 B
(T5) Kotengin+ P+ Rhizo- bacterin +K2SO4	1.70 c	1.36 g	1.53 C	0.79 b	0.62 f	0.70 AB	0.48 ef	0.60 b	0.54 AB	1.55 c	1.43 e	1.49 C
(T6) Kotengin+ Biofertilizer+ K2SO4	1.83 a	1.46 e	1.65 A	0.84 a	0.67 de	0.75 A	0.50 de	0.63 a	0.57 A	1.68 a	1.55 c	1.62 A
Mean*	1.62 A	1.29 B		0.74 A	0.59 B		0.45 B	0.57 A		1.49 A	1.38 B	

C. = Coronaiki cv. M = Manzanillo cv.
* and ** refer to specific effect of olive cultivars and soil NPK mineral respectively. Means fallowed by the same letter/s in each column didn't significantly differ at 5% level.

Table 4: Specific and Interaction effects of olive cultivars, some bio- mineral NPK fertilizers soil applied and their combinations on leaf N, P, K and Ca content (%), during both 2003 and 2004 experimental seasons.

	Leaf N%			Leaf P%			Leaf K%			Leaf Ca%		
Treatments	M	C	Mean**	M	C	Mean**	M	C	Mean**	M	C	Mean**
						2003 season						
(T1) Control	0.45 K	0.51 j	0.48 F	0.10 C	0.12 be	0.11 B	0.67 g	0.86 c	0.77 C	1.25 g	1.53c	1.39 C
(T2) NPK	0.72 I	0.82h	0.77 E	0.12 Bc	0.17 a	0.14 AB	0.80 f	1.04 b	0.92 B	1.34 d	1.61 ab	1.48 A
(T3) Kotengin+ Phosphorene + (NH4)2 SO4+K2SO4	1.13 G	1.28 f	1.21 D	0.13 B	0.18 a	0.16 A	0.81 ef	1.05 b	0.93 B	1.31 e	1.59 ab	1.45 AB
(T4) Kotengin+ Phosphorene + Rhizo- bacterin +K2SO4	1.35 e	1.53 d	1.44 C	0.14 b	0.19 a	0.16 A	0.83 de	1.06 b	0.94 B	1.30 ef	1.58 b	1.44 AB
(T5) Kotengin+ P+ Rhizo- bacterin +K2SO4	1.58 c	1.79 b	1.69 B	0.13 bc	0.17 a	0.15 AB	0.85 cd	1.07 b	0.96 B	1.33 de	1.61 a	1.47 A
(T6) Kotengin+ Biofertilizer+ K2SO4	1.75 b	1.99 a	1.87 A	0.14 b	0.19 a	0.17 A	0.86 c	1.18 aa	1.02 A	1.28 f	1.55 c	1.42 BC
Mean*	1.16 B	1.32 A		0.13 B	0.17 A		0.80 B	1.05 A		1.30 B	1.58 A	
						2004 season						
(T1) Control	0.48 k	0.54 j	0.51 F	0.13 e	0.18 c	0.16 B	0.70 f	0.91 c	0.81 C	1.31 g	1.59 c	1.45 C
(T2) NPK	0.77 i	0.86 h	0.82 E	0.15 de	0.21 b	0.18 AB	0.84 e	1.10 b	0.97 B	1.39 e	1.69 a	1.54 AB
(T3) Kotengin+ Phosphorene + (NH4)2 SO4+K2SO4	1.20 g	1.35 f	1.28 D	0.17 cd	0.24 ab	0.20 A	0.84 e	1.10 b	0.97 B	1.47 d	1.66 ab	1.57 A
(T4) Kotengin+ Phosphorene + Rhizo- bacterin +K2SO4	1.44 e	1.62 d	1.53 C	0.17 cd	0.23 ab	0.20 A	0.84 e	1.10 b	0.97 B	1.36 ef	1.64 ab	1.50 AC
(T5) Kotengin+ P+ Rhizo- bacterin +K2SO4	1.68 c	1.89 b	1.79 B	0.16 ce	0.21 b	0.18 AB	0.88 d	1.11 b	1.00 B	1.39 e	1.67 a	1.53 AB
(T6) Kotengin+ Biofertilizer+ K2SO4	1.87 b	2.12 a	2.00 A	0.17 cd	0.25 a	0.21 A	0.91 c	1.19 a	1.05 A	1.34 fg	1.61 bc	1.48 BC
Mean*	1.24 B	1.40 A		0.16 B	0.22 A		0.83 B	1.09 A		1.38 B	1.64 A	

C. = Coronaiki cv. M = Manzanillo cv.
* and ** refer to specific effect of olive cultivars and soil NPK mineral respectively. Means fallowed by the same letter/s in each column didn't significantly differ at 5% level.

7. Leaf Zinc Content: Table (5) showed obviously the variable response of olive trees to the different combinations during 2003 and 2004 seasons . It could be noticed that the most increasing effect on leaf- Zn content was detected by combinations represented Coronaiki olive trees fertilized with the Biomagic foliar spray + the T6 in 1st experiment (Kotengin + Biofertilizer + K2So4 , soil applied) where the highest increase in leaf- Zn content was resulted. On the other hand, the least increase in leaf-Zn content was detected by Manzanillo olive trees sprayed with NPK solution treatment as compared to control (tap water foliar spray) during both seasons of study. Other combinations were in between the aforesaid two extremes. These results are similar to that achieved by Abd El-Hameed,[25] who mentioned that the interaction between 100 % N and BF + BS gave the highest significant leaf content of Zn in Manzanillo olive trees.

8. Leaf Copper Content: Table (5) showed obviously the variable response during 2003 and 2004 experimental seasons. The highest increase in leaf- Cu content was exhibited by the combination between Manaznillo trees fertilized with Biomagic foliar spray + the T6 or T4 in 1st experiment soil applied and Nofaterin foliar spray + the T6 in 1st experiment soil applied treatments, while the lowest leaf- Cu content was detected by Coronaiki trees fertilized with the solution of NPK foliar spray as compared to those sprayed with tap water (control) during the two seasons of study. Other combination were in between the aforesaid two extremes.

Similar results were obtained by Abd El-Hameed, [25] who found that the interaction between 100% N and BF+ BS gave the highest significant leaf content of Cu in Manzanillo olive trees.

Table 5: Specific and Interaction effects of olive cultivars, some bio- mineral NPK fertilizers (soil, foliar application solely or together) and there combinations on leaf Fe, Mn, Zn and Cu content (ppm) during both 2003 and 2004 experimental seasons

	Leaf Cu ppm			Leaf Zn ppm			Leaf Mn ppm			Leaf Fe ppm		
Treatments	M	C	Mean**	M	C	Mean**	M	C	Mean**	M	C	Mean**
					2003 season							
1. (T1) Control	34.0 n	42.67 k	38.33 G	24.33 j	28.67 hi	26.50 F	17.00 j	21.33 h	19.17 E	10.00 gi	8.67 j	9.33 D
2. (T2) NPK	37.33 m	46.67 i	42.00 F	25.33 j	32.67 fg	29.00 E	18.00 j	22.33 fh	20.17 E	11.43 gh	9.35 ij	9.89 C
3. (T3) Nofaterin foliar spray	41.00 l	51.67 g	46.33 E	29.67 i	37.33 d	33.50 D	20.00 i	25.33 d	22.67 D	11.67 de	9.67 hi	10.67 B
4. (T4) Biomagic foliar spray	44.67 j	56.00 e	50.33 D	30.67 hi	38.33 d	34.50 CD	21.33 h	27.00 c	24.17 CD	12.00 ce	10.67 fg	11.33 AB
5. (T5) Nofaterin + (T4) from 1st exp.	49.67 h	59.33 d	54.50 C	31.67 gh	40.00 c	35.83 BC	22.00 gh	27.67 c	24.83 BC	12.33 bd	10.67 fg	11.50 AB
6. (T6) Nofaterin + (T6) from 1st exp.	49.33 h	62.00 c	55.67 C	33.67 ef	42.00 b	37.83 AB	23.33 ef	29.00 ab	26.17 AB	13.00 ab	11.33 ef	12.17 A
7. (T7) Biomagic+ (T4) from 1st exp.	53.33 f	67.00 b	60.17 B	32.67 fg	41.00 bc	36.83 BC	22.67 eg	28.00 bc	25.33 AC	12.67 ac	10.67 fg	11.67 AB
8. (T8) Biomagic+ (T6) from 1st exp.	57.00 e	71.67 a	64.33 A	34.67 e	43.67 a	39.17 A	23.67 e	29.67 a	26.67 A	13.33 a	11.67 de	12.50 A
Mean*	45.79 B	57.13 A		30.33 B	37.96 A		21.00 B	26.29 A		11.93 A	10.34 B	
					2004 season							
1. (T1) Control	38.00 o	47.67 l	42.83 H	26.67 g	30.33 f	28.50 F	19.33 i	24.33 gh	21.83 E	12.13 g	10.10 i	11.12 D
2. (T2) NPK	41.33 n	51.67 j	46.50 G	27.00 g	35.33 e	31.17 E	20.33 i	25.33 fg	22.83 E	12.33 g	11.00 h	11.67 C
3. (T3) Nofaterin foliar spray	45.67 m	57.67 h	51.67 F	32.67 f	41.00 c	36.83 D	23.00 h	29.00 d	26.00 D	14.33 de	13.00 fg	13.67 B
4. (T4) Biomagic foliar spray	50.00 k	62.33 f	56.17 E	33.33 f	42.00 c	37.67 CD	24.67 g	30.67 c	27.67 CD	14.7 ce	13.30 fg	14.00 AB
5. (T5) Nofaterin + (T4) from 1st exp.	52.67 j	66.33 d	59.50 D	35.00 e	44.00 b	39.50 BC	25.00 g	31.67 bc	28.33 BC	15.33 bd	13.67 ef	14.50 AB
6. (T6) Nofaterin + (T6) from 1st exp.	55.33 i	69.33 c	62.33 C	36.33 e	46.00 a	41.39 AB	26.67 ef	33.00 ab	29.83 AB	16.00 ab	14.33 de	15.17 AB
7. (T7) Biomagic+ (T4) from 1st exp.	59.67 g	74.67 b	67.17 B	35.33 e	44.33 b	39.83 BC	25.67 eg	31.67 bc	28.67 AC	15.67 ac	14.00 ef	14.83 AB
8. (T8) Biomagic+ (T6) from 1st exp.	63.67 e	79.33 a	71.50 A	38.00 d	47.33 a	42.67 A	27.00 e	34.00 a	30.50 A	16.67 a	14.67 ce	15.67 A
Mean*	50.79 B	63.63 A		33.04 B	41.70 A		23.96 B	29.96 A		14.65 A	13.01 B	

C. = Coronaiki cv. M = Manzanillo cv.
* and ** refer to specific effect of olive cultivars and soil NPK mineral respectively. Means fallowed by the same letter/s in each column didn't significantly differ at 5% level.

Table 6: Specific and Interaction effects of olive cultivars, some bio- mineral NPK fertilizers (soil, foliar application solely or together) and there combinations on Shoot N%, Shoot total carbohydrates (g/100 g D.W.) and C/N Ratio during both 2003 and 2004 experimental seasons.

	Shoot N%			Shoot total carbohydrates (mg/100 g D.W.)			C/N Ratio		
Treatments	M	C	Mean**	M	C	Mean**	M	C	Mean**
					2003 season				
1. (T1) Control	0.48 l	0.55 k	0.52 H	5.58 o	6.98 n	6.28 F	11.57 j	12.79 i	12.18 G
2. (T2) NPK	0.78 j	0.87 i	0.83 G	11.31 m	14.18 l	12.74 E	14.58 h	16.26 g	15.42 F
3. (T3) Nofaterin	0.92 i	1.06 h	0.99 F	14.65 k	18.32 j	16.48 E	16.01 g	17.64 f	16.83 E
4. (T4) Biomagic	1.06 h	1.20 g	1.13 E	19.08 i	23.82 h	21.45 D	17.98 f	19.84 e	18.91 D
5. (T5) Nofaterin + (T4) from 1st expe.	1.33 f	1.48 e	1.40 D	25.94 g	32.47 f	29.21 C	19.83 e	22.00 d	20.92 C
6. (T6) Nofaterin + (T6) from 1st expe.	1.50 e	1.64 d	1.57 c	35.10 e	38.38 d	36.74 B	21.44 d	23.45 c	22.44 B

Table 6: Continue

7. (T7) Biomagic+ (T4) from 1st expe.	1.59 d	1.80 b	1.70 B	35.15 e	43.96 b	39.56 B	22.10 d	24.42 b	23.36 B
8. (T8) Biomagic+ (T6) from 1st expe.	1.69 c	1.91 a	1.80 A	39.06 c	48.84 a	43.95 A	24.50 b	25.58 a	25.04 A
Mean*	1.17 B	1.32 A		23.23 B	28.37 A		18.50 B	20.25 A	
				2004 season					
1. (T1) Control	0.49 m	0.56 l	0.53 H	5.87 k	7.33 k	6.60 F	11.90 j	13.19 i	12.55 G
2. (T2) NPK	0.79 k	0.89 k	0.84 g	11.91 j	14.88 i	13.39 E	15.08 h	16.73 g	15.91 F
3. (T3) Nofaterin	0.94 j	1.06 i	1.00 F	15.40 i	19.25 h	17.33 D	16.46 g	18.19 f	17.33 E
4. (T4) Biomagic	1.09 i	1.23 h	1.16 E	20.29 h	25.08 g	22.68 D	18.69 f	20.47 e	19.58 D
5. (T5) Nofaterin + (T4) from 1st expe.	1.35 g	1.51 f	1.43 D	27.31 f	34.11 e	30.71 C	20.49 e	22.66 d	21.58 c
6. (T6) Nofaterin + (T6) from 1st expe.	1.53 f	1.67 d	1.60 C	36.98 d	42.17 c	39.58 B	22.08 d	25.26 b	23.67 B
7. (T7) Biomagic+ (T4) from 1st expe.	1.63 e	1.84 b	1.73 B	36.98 d	46.18 b	41.58 B	22.76 d	25.18 b	23.97 B
8. (T8) Biomagic+ (T6) from 1st expe.	1.73 c	1.95 a	1.84 A	41.09 c	51.36 a	46.22 A	23.78 c	26.37 a	25.07 A
Mean*	1.19 B	1.34 A		24.47 B	30.05 A		18.91 B	21.01 A	

C. = Coronaiki cv. M = Manzanillo cv.
* and ** refer to specific effect of olive cultivars and soil NPK mineral respectively. Means fallowed by the same letter/s in each column didn't significantly differ at 5% level.

C. Shoot Nitrogen, Total Carbohydrate Contents and C/n Ratio:

1. Shoot Total Nitrogen Content: With regard to the interaction effect, data obtained during both seasons in Table (6) displayed that the more pronounced response to specific effect of fertilizing with bio- NPK treatments rather than exhibited by olive cultivar was obviously reflected on the influence of their various combinations. Herein, the highest shoot- N content was significantly in close relationship with Coronaiki olive trees fertilized with Biomagic foliar spray + the T6 in 1st experiment (Kotengin + Biofertilizer + K_2SO_4 soil applied) treatment during both seasons of study. On the contrary, the least increase in shoot- N% content was usually in concomitant to Manzanillo olive trees fertilized with NPK solution foliar spray as compared with the control during 1st and 2nd seasons. In addition, other combinations were in between the abovementioned two extremes.

2. Shoot Total Carbohydrates Content: Table (6) showed obviously significant response during 2003 and 2004 seasons. The most increase influences in total carbohydrates content were exhibited by the combination between Coronaiki fertilized with Biomagic foliar spray + the T6 in 1st experiment soil application (Kotengin + Biofertilizer + K_2SO_4) compared with those of water spray (control) during 1st and 2nd seasons. In addition, the lowest increase effect was found by Manzanillo olive trees fertilized with NPK solution foliar spray. Other combinations were in between. Such trend is in agreement with the obtained results of Hasan,[23] on olive transplants.

3. Shoot C/N ratio: Results in Table (6) showed the effect of interaction between olive cultivar and bio-NPK fertilizer treatments on shoot C/N ratio content. The results revealed that shoot C/N ratio exhibited significantly the highest level by the combination between Coronaiki cv trees fertilized with Biomagic foliar spray + the T6 in 1st experiment soil applied treatment. On the contrary, Manzanillo cvs. sprayed with tap water (control) during the two seasons of study. Other combinations were in between the aforesaid two extremes.

In conclusion, the obtained data revealed that, all foliar sprays as wall as the combination between them significantly increased leaf amino acids content and mineral status, shoot nitrogen and total carbohydrate contents as well as C/N ratio. T6 (Kotengin + Biofertilizer + K_2SO_4) soil applied solely (1st exp.) or combined with Biomgaic foliar spray treatments (2nd exp.) were the superior in this respect.

Therefore, using such treatment combined with Biomgaic foliar spray may be recommended to improve growth of young olive trees specially Coronaiki cv. under this conditions.

REFERENCES

1. Saber, S.M., 1993. The use of multi - strain biofertilizer in Agriculture. Theory and practice. Proc. Sixth International symposium on Nitrogen fixation with non- legumes, Ismailia, Egypt, pp: 61.
2. Saber, S.M., 1993. Associative action of a multi - strain biofertilizer on tomato plants grain in newly reclaimed soils, proc. Sixth International symposium on Nitrogen fixation with non-legumes, Ismailia, Egypt. pp: 150.
3. Khamis, M.A., Z.H. Behairy, M.M. Ibrahim and A.Z. El- Aziz, 1984. Studies on the response of guava and olive seedlings to saline conditions. Moshtohor, Ann. of Agric. Sci., 23: 1224-1232, Egypt.

4. Khamis, M.A., M.M. Ibrahim, Zeinab-Behairy and A. Abd EL-Aziz, 1984. Modification of soil tolerance in relation to some fruit seedlings by foliar application with elements and growth substance. Hort. Dept. Fac. Agric., Moshtohor, Zagazig, Ain Shams University, Egypt, 3rd Arabic Congrees for Horticultre, 7-10.
5. Abd El-Aziz. A.B.K., 2002. physiological studies on biofertilization of banana plants cv. Williams. Ph.D. Thesis, Faculty of Agriculture, Dept. of Horticulture. Minia University, Egypt.
6. Piper, C.S., 1947. Soil and plant analysis. The University of Adelaide (Australia) pp: 59-74.
7. Jackson, M.L., 1967. Soil chemical analysis. Hall. Of India private, New Delhi, India.
8. Jackson, W.A. and R.J. Volk, 1968. Role of potassium in photosynthesis and respiration. Amer. Soc. Agronomy, Madison, Wise, pp: 109-145.
9. Saric, M., R. Kastroi, R. Curic and I. Gerie, 1967. Effect of salinity on some citrus rootstocks. Park Fiziol. Anjiga, P. 215. (Hort., Abst., 38: 319).
10. Moore, S. and W.H. Stein, 1948. Photometric ninhydrin method for use in the chromatography of amino acids. Jour. BIol. Chem., 176: 367-388.
11. Pregl, F., 1945. Quantitave Organic Micro Analysis., 4th Ed., J. A. Churhcill Ltd., London.
12. Murphy, J. and J.P. Riely, 1962. A modified single solution method for the determination of phosphate in natural water. Annal. Chem. Acta, 27: 31-36.
13. Brown, J.D. and O. Lilleland, 1946. Rapid determination of potassium and sodium in plant material and soil extracts by flame photometer. Proc. Amer. Soc. Hort. Sci., 48: 341-346.
14. Chapman, H.D. and P.F. Pratt, 1961. Methods of analysis for soils, plants and water. Div. of Agric. Sci. Univ. of California.
15. Smith, F., A.M. Cilles; K.J. Hamilton and A.P. Gedes, 1956. Colorimetric methods for determination of sugar and related substances. Annalas chem., 28: 350.
16. Snedecor, G.W. and Cochran, 1977. Statistical Methods. 6th Ed., The Iowa State Univ., Press Amer. Iowa, USA.
17. Duncan, B.D., 1955. Multiple range and multiple F tests. Biometrics, 11: 1-42.
18. Jackson, W.A. and R.J. Volk, 1968. Role of potassium in photosynthesis and respiration. Amer. Soc. Agronomy, Madison, Wise, pp: 109-145.
19. Weaver, R., 1976. Grape growing. John Wiley and sons, New York. US.A.
20. Smith, J.H.C. and C.S. French, 1963. The major and accessory pigments in photosynthesis. Ann Rev. Plant., Physiol., 14: 181-224.
21. Castelfranco, P.A. and S.I. Beale, 1983. Chlorophyll biosynthesis recent advances and areas of current interest. Ann. Rev. Plant Physiol., 34: 241-278.
22. Aly, W.A.A., 2005. Improving growth and productivity of olive orchard under desert condition. Ph.D. Thesis Fac. Agric. Cairo Univ, Egypt.
23. Hasan, A.A., 2005. Physicolocial studies on the effect of salt stress on some olive cultivar. Ph. D. Thesis, Fac. of Agric. Moshtohor, Zagazig Univ, Egypt.
24. Girgis, E.G.M., 2005. Phsyiological studies on irrigation of some olive cultivars. Ph. D. Thesis, Fac. Agric., Moshtoher. Zagazig Univ. Benha Branch, Egypt.
25. Abd El- Hameed, S.A., 2002. A comparative study of some citrus rootstocsk grown in different soil types inoculated with mycorrhiziae fungi. M.Sc. Theis, Fac. Agric., Moshtohor, Zagazig University, pp: 146, Egypt.
26. Sharaf, M.M., M.A. Khamis and Z.H. Behairy, 1984. Salt tolerance in guava and olive seedlings as affected by some macro elements. Moshtohor, Annals, Agric. Sci., 23: 1543-1549, Egypt.
27. Abbas, W.A., 1999. Effect of some additives on tolerance of olive plants to salinity. M.Sc. Thesis, Faculty of Agriculture, Cairo University, Egypt.
28. Emtithal, H., S. El-Sayed, I. Laz, A.F. El- Khateeb and M. El- Sayed, 2002. Response of manzanillo olive trees to nitrogen and potassium fertigation under new reclaimed soils conditions. Egypt. J. Appl. Sci., 17(10): 759-769.