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AGGEZI AND KORONEIKI OLIVE TREES AS AFFECTED BY ORGANIC AND BIO – FERTILIZERS, CALCIUM CITRATE AND POTASSEINE

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ABSTRACT

The present study was carried out in an olive orchard at 6th of October city, Giza Governorate, Egypt during 2002 and 2003 growing seasons on "Aggezi" and "Koroneiki" olive cultivars for table and oil purposes, respectively. The objective of this study was to investigate the effect of organic farmyard manure (FYM), compost (COM) manure and biofertilizers (Bio) as the combination between phosphorene and nitrobeine, calcium citrate (Cac) and potasseine (K). Besides, the fertilization program adopted in the farm [N (750g/tree), P_2O_5 (600g/tree) & K_2O (500g/tree)] was used as control. The results revealed that, the application of different aforementioned treatments increased significantly shoot growth (length and diameter, number of leaves shoot and area/leaf) compared to the control in both cultivars (Aggezi and Koroneiki) during the two growing seasons. In this concern, the application of FYM+Cac influenced significantly shoot length & diameter, number of leaves/shoot and area/leaf of Koroneiki cv. and shoot diameter of Aggezi cv. Meantime the area /leaf of both cvs.increased when fertilized by FYM+COM+Cac**.** Whereas, the combination of FYM, COM, Cac, Bio, and K improved significantly blooming characteristics (number of flowers/inflorescence, inflorescence length and perfect flowers %) of Aggezi and Koroneiki olive cvs. However, number of fruits/shoot and yield of both cultivars increased significantly when treated by the combination of organic and biofertilizers, especially FYM+COM+Bio. Moreover, pulp/seed ratio was increased when treated with FYM+Bio (especially in 1st season). In addition, Koroneiki cv. when provided with FYM+COM+Bio treatment produced the richest fruits in their oil content. Aggezi cv. trees when fertilized with the combination of organic manure & calcium, gave higher contents of chlorophyll (A), (B) & total chlorophyll, however, in Koroneiki cv. chlorophyll B didn't affect. Eventually, nutrient elements (NPK) contents didn't take a definite trend except for N which was affected significantly with the different combinations, while P & K in Aggezi leaves were influenced by FYM only. On the other hand, Koroneiki trees treated with COM+Bio had the highest leaf N content. Leaf P content was positively affected by FYM+Cac in

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2002 and FYM+COM+Bio in 2003. Meantime, FYM+K followed by COM+Bio induced the highest stimulative effect on leaf K content.

Key words: Olive trees, Organic manure, Biofertilizer, Calcium citrate, Potasseine, Fruit quality

INTRODUCTION

Olive trees (*Olea europea*, L) grow successfully under the prevailing conditions, where soil is poor and available water is limited. In addition, olive offers a great economic potential compared with other fruits grown under the same conditions **(El-Sharkawy, 1999**). Aggezi olive cv. is the most important table cultivar in Egypt and Koroneiki olive oil cv. imported from Greece. Both cultivars are cultivated in a large scale in new reclaimed areas. Organic manures affect the physical, chemical and biological characteristics of the soil hence, adjusting soil pH, and increasing solubility and nutrients (P, K, Ca & Mg) availability to plant consequently, influence the growth and production of the plants **(Abdel-Nasser & Harhash, 2000)**. Compost is an organic fertilizer and soil amendment that providing plants with mineral nutrition and other benefits **(Kassem and Marzouk, 2002).** Meantime, compost organic manure enhances vegetative growth, fruit weight and N, content in olive trees **(Haggag, 1996).** Biofertilizers are microbial preparation containing primarily sufficient numbers of potent strains of microorganisms and furnishing a beneficial rhizosphere for plant growth. Moreover, biofertilizers have a significant effect of different strain groups such as nitrogen fixers **(Abou EI-Khashab, 2002 and Abou-Taleb *et al* 2004)** and nutrient mobilizing microorganisms which help in the availability of metals and their forms in the composted materials and levels of extractable nutrient elements **(El-Karamany *et al* 2000)**. Bio-application improves plant growth, fruit yield and chemical composition through the exertion of plant promoting substances mainly IAA, gibberellic and cytokinin like substances, vitamins and amino acid content **(Abd El-Mouty *et al* 2001)**. The calcium requirement for optimum growth is much higher in dicotyledons than in monocotyledon plants **(Loneragan and Snowball, 1969)**. Potassium is the second mineral nutrient required in largest amount by plants and calcium as a second messenger has attracted much attention in the last decade based on the very low cytosolic free Ca^{2+}. Moreover, Calcium and potassium play an important role in enzyme activation, protein synthesis, photosynthesis, cation-anion balance, osmoregulation, and cell extension and cell wall stabilization, which reflected on plant growth and fruit production **(Marschner 1995)**. The improvement in olive yield and fruit characters may be attributed to the synergistic effect of the combination between organic manure and biofertilizers or calcium citrate or potassiene through the proper soil conditions and available nutrients which in turn reflected on plant growth and fruit production and quality, besides oil content **(El-Ghadban *et al* 2002)**.

Thus, this work was carried out to investigate the effect of the application of farmyard manure, compost, biofertilization (phosphorene + nitrobeine),

calcium citrate and potasseine compounds on vegetative growth, floral formation, yield, fruit quality and leaf chemical constituents of "Aggezi" (table cv.) and “Koroneiki” (oil cv.) olive trees.

MATERIAL AND METHODS

Olive trees cvs. ("Aggezi" for table and Koroneiki for oil production) were selected to carry out this fertilizer study at a farm at 6th of October City, Giza Governorate, Egypt during the two successive growing seasons 2002 and 2003. The selected trees were mostly uniform in growth, vigour (8 years – old), planted at 6 x 6 metres apart and grown in sandy soil under drip irrigation system with Nile water. The objective of this study was to investigate the effects of organic fertilizers in the form of dried farmyard manure or compost (Nile Compost), biofertilizers in the form of the mixture between nitropeine and phosphorene fertilizers, calcium as calcium citrate 2% (calcium chloride + citric acid) and potassium as potassein on growth, flowering, productivity and fruit properties of “Aggezi” and “Koroneiki olive trees. The experimental soil analysis (Table, 1) of the tested soil were determined at 0-30cm & 30-60cm depth according to **Wilde *et al* (1985)**.

Data of chemical analysis of farmyard manure and compost are presented in Table (2).

Table 1. The experimental soil analysis

Anal.	Depth (cm)	SP	Anions (meq/l)				Cations ((meq/l)			
			Co_3	Hco_3	Cl	So_4	Ca	Mg	Na	K
Soil	0-30	30	-	2.04	68.31	75.73	23.97	12.29	107.12	2.70
Soil	30-60	36.0	-	2.04	41.58	88.15	21.93	15.80	92.56	1.48

Table 2. Chemical analysis of the experimental organic manure

Organic fertilizers	Organic carbon (%)	Moisture content (%)	Organic matter (%)	Macronutrients (%)					Micronutrients (ppm)		
				N	P	K	Ca	Mg	Fe	Mn	Zn
Farmyard manure	20.7	16.2	37.7	1.85	0.85	1.31	2.34	0.77	1200	450	117
Nile compost	28.9	17.8	71.0	1.87	1.48	1.23	1.20	0.34	1400	126	28

Organic manures were applied in the form of farmyard manure and compost at the rates of 50Kg/tree, 45 Kg/tree, respectively, at November 15th. Whereas, nitropeine + phosphorene as a source of biofertilizer was applied at the rate of 60g/tree at January 15th.

Moreover, calcium citrate as a source of calcium and potassein (30% K_2O & 8% P_2O_5) as a source of potassium were added as foliar applications twice/year (before and after blooming by 15 days). In addition, other fertilization program adopted in the farm [P2O5 (600g/tree) in the form of triple calcium super phosphate fertilizers (37.5%), K_2O (500g/tree) as potassium sulphate (48%) and N (750gm / tree) as ammonium sulphate (20.5%)] were used annually as control. The experiment was set in a complete randomized block design with 3 replications (an individual tree/each).

The treatments were arranged as follows :

1. The regular farm dose of fertilizer as a check.
2. Farmyard manure (FYM).
3. Compost manure (COM).
4. FYM + COM.
5. FYM + Biofertilizers (Bio).
6. FYM + Calcium citrate 2% (Cac).
7. FYM + Potassein (K).
8. COM + Bio.
9. COM + Cac.
10. COM + K.
11. FYM + Bio.
12. FYM + Cac.
13. FYM + K.

Picking of "Aggezi" olive fruits was carried out at the last week of August and Koroneiki at the first week of November during 2002 and 2003 growing seasons, respectively.

Sampling and determinations

For every tree, twenty healthy shoots representing the previous spring sprouted shoots (5 in each direction) were selected randomly and labeled for the following measurements:

1. Growth parameters

At the end of growing season (Aug. for Aggezi cv. & Oct. for Koroneiki cv.), the selected shoots were measured for averages of length (cm), diameter (3cm from the shoot base), No. of leaves/ shoot and leaf area (cm2) using area meter CI-203

2. Measurements of some flowering aspects

At full bloom stage, average length of inflorescence, total number of flowers/inflorescence and sex expression were estimated as a perfect flower percentage (on the base of total flowers per each inflorescence).

3. Fruit quality

- No. of fruits/shoot
- Fruit weight (gm).
- Fruit dimensions (length and width) in cm.
- Pulp weight (gm), seed weight (gm) and pulp/seed ratio were determined.
- Yield (kg) / tree
- Oil content (%): was extracted by Soxelt apparatus from the dry fruit (flesh & seed) sample of Koroniki

cv. using petroleum ether (60-80) as a solvent for 16 hours according to the method described by **Juan (1990).**

4. Leaf chemical constituents

a) Pigments

At the end of September, The quantitative analysis of photosynthetic pigments (mg/g) was determined in fresh leaf samples (4 & 5) leaves from the terminal bud). The optical densities were measured colourmetrically at 660 and 640 wavelengths for chlorophyll (A and B), respectively according to **Brougham (1960) .**

b) Leaf minerals content

At the first week of September of each season, leaf samples were taken from mid-shoot **(Jones & Benton, 1994),** then washed, air dried at 70^{o}C till the constant weight and grounded for the determination of N, P, & K, as follows:

* Nitrogen was determined by the MicroKjeldahl method **(Pregl, 1945).**
* Phosphorous was estimated by the method of **Murphy and Riely (1962).**
* Potassium was determined by flame-photometer according to **Brown and Lilleland (1946).**

Statistical analysis

The obtained data was subjected to analysis of variance (ANOVA) according to **Snedecor and Cochran (1980).** Differences between treatments were compared by Duncan,s multiple range test as described in the SAS **(SAS, 1986).**

RESULTS AND DISCUSSION

Growth measurements

The effect of organic fertilizers as farmyard manure (FYM) and compost (COM) manure, biofertilizers (Bio) (nitrobeine + phosphorene), calcium citrate (Ca) and potassein (K) on shoot growth of "Aggezi" and "Koroneiki" olive cvs. are presented in Table, (3). It is obvious that, shoot growth parameters (length, diameter, number of leaves/shoot and area/leaf) were significantly influenced by different aforementioned fertilization treatments compared to the control in both cultivars during the two growing seasons. Hence, FYM + COM + Bio treatment has the highest shoot length in 2002, and FYM + COM + K treatment in 2003 growing season for Aggezi cv. As for shoot diameter, FYM + Cac has the highest values during both seasons. However, COM only & FYM+K treatments surpassed other treatments during 2002 and COM + Cac during 2003 season. As for number of leaves / shoot FYM + Bio, COM + K & FYM + COM + Cac treatments were the superior for Aggezi cv. Whereas, FYM + Cac achieved the highest records for shoot length, number of leaves/shoot specially during 2002 season and shoot diameter during 2002 & 2003 seasons for Koroneiki olive cv.. Meantime, FYM + COM + K for shoot length & COM+Bio for number of leaves surpassed other treatments during 2003, while, FYM+ Cac & COM+ Cac was the superior for shoot diameter. Besides, in Koroneiki olive trees area per leaf was extremely affected by FYM+ Cac during

both seasons of study and FYM + COM + Cac treatment during 2002 season Moreover, COM + Cac in 2002. COM + K, FYM + COM + Bio & FYM + COM + Cac during 2003. These results coincide with **Haggag, (1996)** findings on olive as affected by composed town refuse. In addition, **Villasudra & Baluyut, (1990)** on guava and **El-Morshedy, (1997)** on sour orange concluded that, organic manure (farmyard manure and compost) increased vegetative growth and nutritional status. Furthermore, **Abd El-Moez *et al* (1999)** reported that the significant positive effect of compost fertilizers on vegetative growth characters may be due to the improvement in soil physical and biological properties and also, the chemical characteristics resulting in more release of available nutrient elements to be absorbed by plant root and its effect on the physiological processes such as photosynthesis activity as well as the utilization of carbohydrates, in addition to water use efficiency by different plants. Moreover, recent works **(Abou El-Khashab, 2002 and Abou-Taleb *et al* 2004)** on olive seedlings and trees & **(Mahmoud and Mahmoud, 1999)** on peach as affected by biofertilizers, they proved that biofertilizers improved the plant vigor and growth. The increase in plant growth may be attributed to the capability of microorganisms in biofertilizers to produce growth regulators such as auxins, cytokinins and gibberellins which affect growth and nutrient uptake **(Soliman, 2001).** The favorable effects of the combination between organic manure, biofertilizers or calcium citrate besides potassein may be explained the beneficial effects on physical and chemical soil structure, water uptake and nutrient availability resulting in improving plant growth and productivity **(Bashan *et al* 1989).**

Blooming parameters

Table, (4) shows the effect of FYM, COM, Bio, Cac & K fertilizers on blooming characteristics [number of flowers/ inflorescence, inflorescence length and sex expression (as perfect flowers %)] of Aggezi & Koroneiki olive trees. In this concern, Aggezi cv. didn't take a definite trend by the aforementioned treatments compared to the control. As for the number of flowers / inflorescence, FYM + COM + Cac treatment had the highest values followed by FYM + Bio treatment during 2002 growing season, meantime, FYM + COM + Bio achieved the same effect during 2003. Regarding the inflorescence length, COM + Cac treatment surpassed other treatments during both seasons. With the respect of perfect flowers%, FYM + COM+ treatment was the most effective especially for Aggezi cv., however, the same treatments increased significantly the aforementioned blooming characters of Koroneiki olive trees (Table, 4) as compared to the control. In addition, FYM + COM + K treatment was the superior for number of flowers and inflorescence length values during 2002 season. Meantime, COM + Cac treatment followed by FYM + COM + Cac exceeded other treatments for sex expression records during 2002 season, whiles, FYM+K followed by COM + K treatment achieved the highest values during 2003 growing season.

These results are consistent with the findings of **Eassa (2000); Youssef *et al* (2001); Zaghloul (2002) and Abou-Taleb *et al* (2004).**

Yield, fruit quality and oil content

Data in Tables (5, 6 and 7) revealed that all the tested treatments increased significantly no. of fruits / shoot, yield (Kg / tree) of both studied cvs. and produced fruits richer in their oil content (Koroneiki cv) during both seasons and fruit weight (especially in 2nd season of Aggezi cv.) as compared to the control. In this concern, No. of fruits / shoot respond significantly to FYM, COM, FYM + Cac and FYM + COM + Bio treatments (especially in 2nd season).

Additionally, Aggezi trees treated with FYM + COM + Cac & FYM + Cac in 2002 and FYM + COM + Cac in 2003 season exerted the highest values of yield (kg. /tree). Moreover, Koroneiki cv. when provided with FYM + COM + Bio treatment produced the richest Koroneiki fruits in their oil content during both seasons followed by FYM + COM + K treatment in 1st season and FYM + Cac treatment in 2nd season.

Generally, adding FYM + COM or FYM + COM + Bio exerted higher positive effect on fruit weight in 2002 and 2003 seasons of Koroneiki cv while, FYM + Cac was the most effective treatment on No. of fruits / shoot and yield (kg/tree) in 1st and COM + K & FYM + COM + Cac in 2nd season. Also, FYM, COM + K & FYM + COM + Cac treatments succeeded in increasing pulp/seed ratio of Aggezi fruits during 2002 and FYM & FYM + COM + K treatments in 2003 season. On the other hand, pulp/seed ratio of Koroneiki fruits was extremely affected by the application of FYM + Bio during 2002 and COM during 2003 growing season. These results were coinciding with the findings of **Haggag (1996); Abd El-Hameed (2002) and Abou-Taleb *et al* (2004)** on olive; **Abou-Hussein *et al* (2002)** on other crops and **Tayeh (2003)** on citrus. In addition, foliar application of calcium chelate improved fruit set, production and oil content of "Manzanillo" and "Picual" cvs. **(Eassa, 2000).** The improvement in olive yield and fruit characters may be attributed to the synergistic effect of the combination between organic manure (FYM & COM) and biofertilizers or calcium citrate or potassein through the proper soil conditions and available nutrients which in turn reflected on plant growth and fruit production and quality, besides oil content **(El-Ghadban *et al* 2002).**

Leaf chemical constituents

a) Pigments

The effect of tested treatments on leaf chlorophyll content of Aggizi olive cv. is shown in Table (8). These data indicated that all treatments increased significantly chlorophyll (A) and total chlorophyll contents during both seasons and chlorophyll (B) especially in 2nd season compared to the control. In this respect, applying FYM+COM+Cac gave higher records of chlorophyll (A) and total chlorophyll (in both seasons) on Aggezi olive trees and COM+K treatment for chlorophyll (A) in 2nd season only. However, chlorophyll (B) was significantly affected by the application of COM + Cac (especially in 2nd season). These results are going in harmony with **Abou El-Khashab, (2002)** on olive seedlings. The increase in leaf photosynthetic pigments might be a result of a balanced nutritional environment in the soil and thus kept iron physiologically active for chlorophyll

Table 8. Aggezi olive cv. leaf chlorophyll (A, B & total chlorophyll) content as affected by the application of organic (farmyard manure and compost),biofertilizers (nitrobeine and phosphorene), calcium citrate and potasseine during 2002 & 2003 growing seasons.

Treatments					Chlorophyll (A) (mg/g)		Chlorophyll (B) (mg/g)		Total chlorophyll (mg/g)	
FYM*	COM✹	BIO^{x}	Cac^{y}	K^{z}	2002	2003	2002	2003	2002	2003
-	-	-	-	-	0.56 D	0.462 D	0.44 B	0.40 DE	1.00CD	0.86 C
+	-	-	-	-	1.09B-D	0.940 B-D	1.44 A	1.53 A	2.53 B	2.47 AB
-	+	-	-	-	1.06B-D	1.504 A-D	0.86 AB	0.73 B-E	1.92BC	2.24 AB
+	+	-	-	-	0.75 CD	1.029 A-D	0.32 B	0.38 DE	1.07BC	1.41 BC
+	-	+	-	-	1.75 AB	1.683 A-C	0.51 B	0.68 C-E	2.26 B	2.36 AB
+	-	-	+	-	1.62 AB	1.667 A-C	0.38 B	0.24 E	2.02BC	1.91 AB
+	-	-	-	+	1.37A-C	1.472 A-D	0.53 B	0.59 C-E	1.91BC	2.06 AB
-	+	+	-	-	1.37 AB	1.469 A-D	0.63 B	0.57 C-E	2.01BC	2.04 AB
-	+	-	+	-	1.67 A	1.694 A-C	0.47 B	0.97 BC	2.14 B	2.66 A
-	+	-	-	+	1.96A-D	1.971 AB	0.41 B	0.51 C-E	2.37 B	2.49 AB
+	+	+	-	-	1.25 A	1.316 A-D	1.03 AB	0.85B-D	2.96 B	2.16 AB
+	+	-	+		1.87 D	2.065 A	1.57 A	0.92B-D	3.45 A	2.99 A
+	+	-	-	+	0.59 D	0.726 CD	0.32 B	1.27 AB	0.92 D	2.00 AB
(Koroneiki olive cv.)										
-	-	-	-	-	0.94 F	0.82 D	0.61 AB	0.529 A	1.56 D	1.35 G
+	-	-	-	-	1.16 EF	1.00 CD	0.88 AB	0.989 A	2.04 CD	1.99 E-G
-	+	-	-	-	1.15 EF	1.48 B-D	1.07 AB	0.817 A	2.23 BD	2.29 D-E
+	+	-	-	-	1.48 D-F	1.31 B-D	0.40 AB	0.468 A	1.88 CD	1.87 FG
+	-	+	-	-	1.62 C-F	1.96 A-C	0.74 AB	0.666 A	2.37B-D	2.63 C-F
+	-	-	+	-	2.43 A-C	2.15 AB	0.82 AB	0.935 A	3.26 AB	3.09 A-D
+	-	-	-	+	2.01 A-E	1.63 A-D	0.35 AB	0.503 A	2.37B-D	2.13 E-G
-	+	+	-	-	2.22 A-D	1.59 B-D	0.13 B	0.597 A	2.36B-D	2.18 E-G
-	+	-	+	-	2.69 A	2.24 AB	0.94 AB	0.379 A	3.64 A	3.62 AB
-	+	-	-	+	1.73 B-F	2.10 AB	1.14 AB	0.799 A	2.88A-C	2.90 B-E
+	+	+	-	-	2.55 AB	1.97 A-C	1.07 AB	0.313 A	3.62 A	3.24 A-C
+	+	-	+		2.61 AB	2.61 A	1.23 A	0.302 A	3.84 A	3.91 A
+	+	-	-	+	1.57 C-F	1.47 B-D	0.69 AB	0.576 A	2.26B-D	2.04 E-G

* = Farm yard manure ✹= Compost x = Phosphorene & nitropeine y = Calcium citrate z = Potasseine
Means having the same letter (s) in each column are not significantly differ at 5% level.

Table 9. Aggezi olive cv. leaf nitrogen, phosphorus & potassium contents as affected by the application of organic (farmyard manure and compost), biofertilizers (nitrobeine and phosphorene), calcium citrate and potasseine during 2002 & 2003 growing seasons

Treatments					N (%)		P (%)		K (%)	
FYM*	COM●	BIO[x]	Cac[y]	K[z]	2002	2003	2002	2003	2002	2003
-	-	-	-	-	1.29 AB	1.30 D-F	0.505 B-E	0.175B-D	0.2013E	0.367 B-C
+	-	-	-	-	1.71 A	1.48 B-E	0.413 A	0.417A	0.526 A	0.537 A
-	+	-	-	-	1.53 AB	1.53 A-E	0.226 B-D	0.238BC	0.233 DE	0.234 D
+	+	-	-	-	1.56 AB	1.62 A-E	0.196 B-E	0.192BD	0.335 CD	0.465 A-C
+	-	+	-	-	1.80 A	1.54 A-E	0.286 B	0.268 B	0.352 C	0.409 B-D
+	-	-	+	-	1.44 AB	1.43 C-E	0.157 DE	0.158CD	0.399 BC	0.400 B-D
+	-	-	-	+	1.43 AB	1.54 A-E	0.173 C-E	0.177B-D	0.484 AB	0.484 A-C
-	+	+	-	-	1.54 AB	1.94 A	0.147DE	0.147 CD	0.310 CD	0.617 A
-	+	-	+	-	1.37 AB	1.49 B-E	0.117 E	0.126 D	0.297C-E	0.324 CD
-	+	-	-	+	1.66 A	1.70 A-D	0.227B-D	0.223B-D	0.365 C	0.383 B-D
+	+	+	-	-	1.08 C	1.19 EF	0.263BC	0.261 B	0.383 BC	0.383 B-D
+	+	-	+		0.82 C	0.92 F	0.148DE	0.145CD	0.334CD	0.328 CD
+	+	-	-	+	1.77 A	1.92 AB	0.157DE	0.144CD	0.351 C	0.363 B-D
(Koroneiki olive cv.)										
-	-	-	-	-	1.83 A-C	1.66 A-C	0.175 BC	0.172BC	0.567C-E	0.468E-G
+	-	-	-	-	1.71 A-C	1.71 A-C	0.150 CD	0.143 C	0.637B-E	0.560C-E
-	+	-	-	-	1.37 C	1.43 BC	0.154 B-D	0.159 C	0.524DE	0.500D-E
+	+	-	-	-	1.59 BC	1.53 A-C	0.159 B-D	0.163 C	0.615B-E	0.635B-D
+	-	+	-	-	1.93 A-C	1.87 A-C	0.168 B-D	0.1863-C	0.562 C-E	0.585B-E
+	-	-	+	-	1.87 A-C	2.11 A	0.238 A	0.224AB	0.647B-C	0.649 BC
+	-	-	-	+	1.47 C	1.43 BC	0.164 B-D	0.157 C	0.829 A	0.851 A
-	+	+	-	-	2.22 A	2.11 A	0.14 3CD	0.180A-C	0.684 B	0.710 B
-	+	-	+	-	1.49 C	1.37 C	0.124 D	0.157 C	0.491 E	0.497D-F
-	+	-	-	+	1.91 A-C	2.00 A-C	0.146 CD	0.160 C	0.483 E	0.498D-F
+	+	+	-	-	1.69 C	1.75 A-C	0.200 AB	0.230 A	0.320 F	0.383 FG
+	+	-	+		2.16 AB	2.02 A-C	0.145 CD	0.148 C	0.328 F	0.334 G
+	+	-	-	+	1.89 A-C	1.77 A-C	0.144 CD	0.157 C	0.363 F	0.351 FG

* = Farm yard manure ● = Compost x = Phosphorene & nitropeine y = Calcium citrate z = Potasseine
Means having the same letter (s) in each column are not significantly differ at 5% level.

synthesis in certain plants **(El-Morshedy, 1997).**

b- Leaf minerals content

The response of leaf nutrient contents (NPK) of Aggezi and Koroneiki olive cvs. as affected by organic fertilizers, biofertilizers, calcium citrate and potassein didn't take a definite trend as shown in Table (9). In this concern, N leaf content of Aggezi olive cv. was positively affected by various treatments e.g. FYM + Bio, FYM + COM + K, FYM & COM + K during the 1st season. Whiles, COM + Bio followed by FYM + COM + K treatment affected leaf N content in 2nd season. However, the application of FYM solely increased leaf P & K contents during the two growing seasons compared to other treatments.

On the other hand, Koroneiki trees treated with COM + Bio had the highest leaf N content during 2002 & 2003 seasons followed by FYM + COM + Cac in 1st season and FYM + Cac during the 2nd one. Leaf P content was positively affected by FYM + Cac in 2002 and FYM+ COM + Bio in 2003. Meantime, FYM + K followed by COM + Bio induced the highest increase in leaf K content.

These results are similar to the findings of **Haggag (1996)** on olive, **El-Morshedy (1997); Abd El-Nasser & Harhash (2000) and Kassem & Marzouk (2002)** on other fruit trees. They revealed that, available soil nutrients were increased due to organic manure application, which in turn improve soil porosity, infiltration rate and retention. However, K content was under the threshold, but some treatments supported the plants to approach the beginning of the threshold especially FYM + K and COM + Bio treatments.

It is worth to mention that leaf nitrogen and phosphorus content of olive was around the optimum values as mentioned by **Jones & Benton (1994)**. The aforementioned treatments enabled the trees to reach the maximum values in these ranges above the threshold. However, K content was under the threshold, but some treatments supported the plants to approach the beginning of the threshold.

CONCLUSION

From the present study we can recommend the combination between organic manure (in the form of FYM or COM) with either biofertilizers, (in the form of nitropeine + phosphorene) or foliar application of calcium or potassium for improving olive trees growth, flowering, productivity and fruit quality under the same conditions of our study.

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مدى تأثر أشجار الزيتون العجيزى والبيكوال للتسميد العضوى والحيوى وسترات الكالسيوم والبوتاسين

[26]

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أجريت هذه الدراسة فى مزرعة بمدينة السادس من أكتوبر – محافظة الجيزة، جمهورية مصر العربية خلال موسمى النمو 2002، 2003 على أشجار الزيتون صنفى العجيزى (للمائدة) والبيكوال (للزيت) وذلك لدراسة تأثير الأسمدة العضوية فى صورتين السماد البلدى أو الكمبوست، الأسمدة الحيوية فى صورة خليط من النيتروبين والفوسفورين وكذلك الرش الورقى بسترات الكالسيوم والبوتاسين. إضافة إلى برنامج التسميد المتبع فى المزرعة كمقارنة[ن (750جم/ الشجرة)، فو$_2$أ$_5$ (600جم/الشجرة)، بو$_2$أ (500جم/الشجرة] وقد أثبتت النتائج أن إضافة المعاملات المختلفة تحت الدراسة أدت إلى زيادة معايير النمو الخضرى (طول و سمك الأفرع، عدد الأوراق/ الفرع، مساحة الورقة) وذلك عند مقارنتها بالكنترول خلال موسمى الدراسة وخاصة عند المعاملة بالسماد البلدى + سترات الكالسيوم حيث أعطت أعلى قيم لطول وسمك الأفرع، عدد الأوراق/الفرع، مساحة الورقة لصنف الكروناكى، سمك الفرع لصنف العجيزى. كذلك أدت المعاملة بالسماد البلدى+ الكمبوست + سترات الكالسيوم إلى زيادة مساحة الورقة لكلا الصنفين.أدى استخدام الخليط بين السماد البلدى، الكمبوست، السماد الحيوى، سترات الكالسيوم ،البوتاسين إلى تحسين خصائص التزهير (عدد الأزهار/النورة، طول النورة، %للأزهار الخنثى) لصنفى الزيتون العجيزى و البيكوال. إضافة السماد العضوى (السماد البلدى، الكمبوست) إلى السماد الحيوى أدت إلى زيادة عدد الثمار/الفرع، المحصول/الشجرة لكلا الصنفين زيادة معنوية. علاوة على ذلك فقد زادت نسبة اللحم : البذرة عند إضافة السماد البلدى إلى السماد الحيوى (خاصة فى الموسم الأول). كما أعطت ثمارصنف الكروناكى أعلى معدل من محتواها من الزيت عن معاملتها بخليط من السماد البلدى + الكمبوست + السماد الحيوى. عند معاملة صنف العجيزى بالسماد العضوى + سترات الكالسيوم زادت نسبة الكلوروفيل (أ ، ب)، الكلوروفيل الكلى، أما كلوروفيل (ب) لم يتأثر فى صنف الكروناكى. بالنسبة لمحتوى الأوراق من العناصر (ن، فو، بو) لم تأخذ

اتجاها معينا، فيما عدا عنصر النيتروجين فقد تأثر معنويا بمعاملات الخلط المختلفة، أما عنصرى الفوسفور و البوتاسيوم فى صنف العجيزى قد زادت عند إضافة السماد البلدى فقط. ،من جهة أخرى فقد سجلت أوراق صنف الكرونـاكى أعلى قيم لعنصر النيتروجين عند المعاملة بالكمبوست + السماد الحيوى. أما عنصر الفوسفور فقد تأثر تأثيرا إيجابيا بخليط السماد البلدى + سترات الكالسيوم (موسم 2002) ، السماد البلدى + الكمبوست + السماد الحيوي (موسم 2003)، فى حين سجل عنصر البوتاسيوم أعلى القيم عند إضافة البوتاسين إلى السماد البلدى يليه الكمبوست إلى السماد الحيوى.

نستخلص مما سبق: أنه عند الخلط بين السماد العضوى، الحيوى، سترات الكالسيوم والبوتاسين يمكن أن يحسن النمو والإنتاجية والمحتوى الكيماوى لأشجار الزيتون صنفى العجيزى والبيكوال تحت ظروف منطقة السادس من أكتوبر بمحافظة الجيزة بجمهورية مصر العربية.

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