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EFFECT OF DIFFERENT DOSES OF NITROGEN AND POTASSIUM ON LEAF MINERAL CONTENT, FRUIT SET, YIELD AND FRUIT QUALITY OF CHEMLALI OLIVE TREES GROWN IN A SANDY SOIL.

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ABSTRACT

This investigation was carried out during 2000 and 2001 seasons on Chemlali trees grown in a sandy soil, to study the effect of different doses of ammonium nitrate and potassium sulphate on leaf mineral content, leaf carbohydrate content, fruit set percentage, yield and fruit quality. The results could be summarized as follows:

Treated trees with (1.5 Kg ammonium nitrate + 1 Kg potassium sulphate) T_5, or (2Kg ammonium nitrate + 0.5 kg potassium sulphate) T_6 and (2 Kg ammonium nitrate + 1Kg potassium sulphate) T_7 gave a significant increment in leaf nitrogen content, fruit weight / tree (kg), no. of flowers per inflorescence and fruit length in both seasons as well as increased flesh weight and flesh percent in the first and in the second seasons for leaf potassium content. The concentration of leaf phosphorus, non reducing sugars and total sugars in both seasons as well as total carbohydrates in the first season were not affected by soil applications.

Yet added (2 Kg ammonium nitrate + 0.5 Kg potassium sulphate) T_6 and (2 Kg ammonium nitrate + 1 Kg potassium sulphate) T_7 significantly increased fruit set %, oil % in the fruit flesh and moisture % in both seasons.

The results also indicated that T_4 (1.5 Kg ammonium nitrate + 0.5 Kg potassium sulphate), T_5, T_6 and T_7 increased both leaf reducing sugars, starch in both seasons as well as increased flesh weight, flesh % and total carbohydrates in the second season. Likewise, all soil applications, except T_2 (1.0 Kg ammonium nitrate + 0.5 kg potassium sulphate) significantly increased fruit weight, leaf and fruit nitrate.

INTRODUCTION

Olive *(Olea Europea, L.)* is one of the oldest cultivated tree crops in the history of the world about 8000 years ago. It was originated in the ancient times in the eastern side of the Mediterranean Sea (Hartmann and Papaioannou, 1971). Olive has spread to all the countries around the Mediterranean basin, which is still the major region of olive production until today.

Olive is one of the most important and popular fruit crops in Egypt and its total acreage exceeded rapidly during the last years, especially in the newly reclaimed lands. According to the latest statistical estimates of Ministry of Agriculture (2002), The total acreage grown with olive reached about 113080 feddans, with total production of about 293903 tons fruits.

Olive fruits are chiefly used for oil extraction or pickling. Yet, oil production is by far the most important source of income; being greatly priced for its fine flavor and cooking properties. Despite the competition from edible oils, increased production of olive oil, is still desirable to meet the high demands of non-producing or even producing countries. (Bailey, 1961).

In soil of low fertility such as sandy soils, olive plants suffer from lack of nutrient elements. Hence, growth of the trees is week, reflected on reducing tree production. This trials aimed to stimulate growth of olive trees through improving fertilization program which play important role in activating growth, fruiting encouraging cell division and stimulating the biosynthesis of organic foods (Nijjar, 1985 and Blevins and Lukaszewski, 1998). Olive tree grown under sandy soil responds very well to the application of macronutrients (Ferreira *et al.*, 1980; klein and Winbaum, 1985; Al- Saket, 1987; Cimato *et al.*, 1990; Arquero *et al.*, 2000; Connell *et al.*, 2000; Ragab, 2002 and Ahmed and Ragab, 2002).

Nitrogen is one of the major nutrients, which is considered an important aspect and limiting factor for productivity of olive tree because tree absorb large amounts of it from the soil (Haggag, 1996 and Amit Jasrotia *et al.*, 1999). Likewise, potassium is a very important essential element which is commonly in short supply in the soil, and it is extensively used in fertilization in Egyptian olive orchards, (Klein and lavee. 1977).

Therefore, the present investigation was carried out to study the effect of different soil application rates of nitrogen and potassium fertilizers on leaf mineral content, fruit set, yield and fruit quality including oil content in Chemlali olive cultivar grown under sandy soil conditions.

MATERIALS AND METHODS

The present study was carried out during two successive seasons (2000 and 2001) in order to study the effect of different doses of nitrogen and potassium fertilizations on the nutritional status and fruit quality of Chemlali raised from olive trees *(Olea Europea, L.)*. The trees were grown in a private orchard, located at Esmailia - Cairo desert road. The trees were nine-years old and grown in a sandy soil at 6X6 meters apart. All trees were pruned in winter and annually fertilized with organic manure at a rate of 20 M^3/fed., in December, besides, calcium superphosphate (15.5% P_2O_5) at a rate of 1.5 kg/tree in January. The orchard under surface irrigation system. A composite sample was taken from the soil of the experimental farm and analyzed by the methods of (Jackson, 1967), one week prior to commencing the experiment. Physio-Chemical properties of the soil are shown in Table (1).

Twenty eight trees, as uniform as possible, were selected for this study and received to the following fertilizer treatments:

1- 0.5 Kg ammonium nitrate + 0.5 kg potassium sulphate (control)
2- 1.0 Kg ammonium nitrate + 0.5 kg potassium sulphate
3- 1.0 kg ammonium nitrate + 1.0 kg potassium sulphate
4- 1.5 kg ammonium nitrate + 0.5 kg potassium sulphate
5- 1.5 kg ammonium nitrate + 1.0 kg potassium sulphate

6- 2.0 kg ammonium nitrate + 0.5 kg potassium sulphate
7- 2.0 kg ammonium nitrate + 1.0 kg potassium sulphate

Table (1): Soil chemical and physical properties for the experimental orchard.

Parameter	Unit	Soil depth (cm)		
		0-30	30-60	60-90
PH		8.1	8.1	8.1
EC	dSm^{-1}	0.49	0.25	0.28
Soluble Cations:				
Ca^{2+}	meq/l	1.3	0.7	0.9
Mg^{2+}	meq/l	0.6	0.4	0.3
Na^{+}	meq/l	2.9	1.3	1.5
K^{+}	meq/l	0.1	0.1	0.1
Soluble Anions:				
HCO_3^-	meq/l	0.9	0.6	0.7
Cl_2^-	meq/l	3.0	1.2	1.4
SO_4^{2-}	meq/l	1.0	0.7	0.7
$CaCO_3$	%	3.5	2.8	2.7
Gravel	%	0.80	1.10	1.15
Sand	%	96.23	95.24	94.60
Silt	%	1.12	1.06	1.55
Clay	%	1.85	2.60	2.70
Texture		Sand	Sand	Sand

The experiment was arranged in a randomized complete block design with four replicates for each treatment and each replicate was represented by one tree.

Potassium sulphate fertilizer was applied in two equal doses in the last week of February and May. Whereas, ammonium nitrate fertilizer was applied in three doses in the last week of February, May and August.

For evaluating the studied treatments on fruit set, two main branches, on the east and west sides of each tree were tagged in April of the two experimental seasons. The number of flowers per inflorescence was determined at full bloom on the selected branches (Kilany and Kilany, 1990). After a month, data were recorded for fruit set percentage (El-Sharkawy, 1999).

On August, 15 of both seasons, 40 leaves, were taken at random from the middle of non-fruiting terminals previously tagged in spring, from all over the outer circumference of the experimental trees for mineral analysis. The leaves were thoroughly washed with tap water, rinsed with distilled water and oven dried at 70°c to constant weight. The dried leaf material of each

sample was then ground in a porcelain mortar to avoid contamination. 0.3 gm from each ground sample was digested with H_2SO_4 and H_2O_2 according to Evenhuis and DeWaard (1980). Suitable aliquots were then taken for mineral determinations. Total nitrogen and phosphorus were determined colorimetrically according to (Evenhuis, 1976) and Murphy and Riley (1962), respectively. Potassium was determined by a flam photometer.

For the nitrate determination, 0.5 gm of dried material (leaf or fruit) was shaken in 20 ml distilled water for 20 minutes, then filtered (Bar-Akiva, 1974). An aliquot disulfonic acid method of the filtrate was used for analysis according to (Bremner, 1965).

For extracts of sugars, half of gram from the dry ground material of the leaf tissues of each replicate was plunged into 80% ethanol, boiled for 30 minutes and the extract was decanted. The residue was re-extracted twice in fresh 80% ethanol for another 15 minutes and the resultant extracts were combined, and made up to volume by 80 percent ethanol. The residue remained, after alcoholic extraction, was used for the determination of starch and the insoluble nitrogen fractions.

Reducing and total soluble sugars were determined in the alcoholic extract by the Nelson arsenate-molybdate colorimetric method (Malik and Singh, 1980) before and after hydrolysis with concentrated HCl. The non-reducing sugars were calculated by the difference between total so.uble sugars and reducing sugars. The starch content was determined in the residue remaining after sugar extraction. A 0.1g of the residue was hydrolyzed with concentrated HCl for three hours under reflux condenser (A.O.A.C., 1950) and the reducing potential of the hydrolysate was determined by the arsenayte-molybdate method. A factor of 0.9 was used to calculate starch (Woodman, 1941). The different carbohydrate fractions were expressed as percent on dry weight basis.

At harvest time, on September, 15 in both seasons, the yield of each tree was collected and a sample of 50 fruits was taken. In each fruit sample, the average fruit weight, fruit diameter and length, flesh and seed weight were recorded. The equatorial diameter as well as the length of each individual fruit was measured by vernier caliper and the average was calculated. The molsture percentage was determined after the fruits flesh was oven dried to a constant weight at 60°C.

The oil content of the fruits was determined by extracting oil from 5gm dried material by means of Soxhalt fat-extracting apparatus using petroleum ether at 60°-80°C boiling point. Oil extraction was carried out for about 8 continuous hours (A.O.A.C. 1980).

Data were statistically analysed according to Snedecor and Cochran (1990), and L.S.D. test at 0.05 level was used for comparison between treatments.

RESULTS AND DISCUSSION

1-Effect of soil application with nitrogen and potassium on the leaf N, P and K content of Chemlali olive trees:

Data in Table (2) clearly show that leaf N significant increased, when the trees were subjected to T_5 (1.5 kg ammonium nitrate + 1.0 kg potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) in both seasons. This increment in leaf N level might be due to the addition of nitrogen in all these fertilizer combinations or might be to the presence of potassium at a suitable level which improved the absorption and translocation of nitrogen by the plants. These results are in agreement with those obtained by Klein and Lavee (1977), Jordao *et al.* (1994), Perica *et al.* (1994), Nijensohn and Maffei (1995) and Sourour (2003). They reported that the application of nitrogen in combination with potassium caused an increase in the leaf nitrogen.

As regards to P leaf content of, the data showed that the application of various rates of N and K caused no clear effect on the phosphorus concentration in the leaves, also no significant differences were found among all treatments. These results are in agreement with those observed by Miao *et al.* (1993), Nijensohn and Maffei (1995) and Sourour (2003).

Table (2): Effect of soil application with nitrogen and potassium on leaf nitrogen, phosphorus and potassium contents of Chemlali olive trees, 2000 and 2001.

Treatments	N%		P%		K%	
	2000	2001	2000	2001	2000	2001
T_1	1.22	1.24	0.22	0.23	1.88	1.75
T_2	1.26	1.27	0.22	0.23	1.89	1.86
T_3	1.32	1.36	0.22	0.22	1.93	1.96
T_4	1.35	1.37	0.21	0.22	1.94	2.00
T_5	1.38	1.45	0.21	0.21	2.00	2.43
T_6	1.40	1.46	0.20	0.21	2.03	2.70
T_7	1.41	1.47	0.20	0.20	2.04	2.91
$L.S.D._{0.05}$	0.16	0.20	N.S	N.S	N.S	0.48

The combinations between nitrogen and potassium treatments did not cause a significant difference in the concentration of potassium in the leaves in the first season. However, in the second one, the treatments T_5 (1.5 kg ammonium nitrate + 1.0 kg potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) gave a significant increase in potassium concentration as compared with the control, (Table 2). The obtained data in the first season are in line with those obtained by Nijensohn and Maffei (1995) and Sourour (2003) working on olive trees. They reported that leaf

potassium content was unaffected by potassium and nitrogen fertilization. However, the results in the second season are in line with those reported by Perica *et al.* (1994); working on olive trees. They found that a distinct increase in leaf content of potassium with increasing the level of nitrogen plus potassium fertilizer application. On the other hand, Jordao *at al.* (1994) and Sourour (2003) working on olive trees found that the addition of high amounts of nitrogen with potassium caused a significant decrease in leaf potassium.

2- Effect of soil application with nitrogen and potassium on the leaf and fruit nitrate content of Chemlali olive trees:

Data presented in Table (3) show the effect of NK fertilizations on leaf and fruit NO_3– N contents. The data indicated that there were significant differences between the control and all treatments in both seasons except T_2 (1.0 Kg ammonium nitrate + 0.5 kg potassium sulphate). These results are similar to those obtained by El- Sisy (2001) worked on NK fertilization of guava trees.

Table (3): Effect of soil application with nitrogen and potassium on leaf and fruit nitrate contents of Chemlali olive trees, 2000 and 2001 (mg NO_3- N/100g dry weight).

Treatments	Leaf		Fruit	
	2000	2001	2000	2001
T_1	83	87	31	40
T_2	85	89	35	44
T_3	96	117	39	49
T_4	97	119	42	51
T_5	100	126	47	56
T_6	116	126	50	62
T_7	128	131	54	65
$L.S.D._{0.05}$	13	16	8	9

3- Effect of soil application with nitrogen and potassium on reducing, non-reducing, total sugars, starch and total carbohydrates:

In both seasons of the study, the results in Table (4) indicated that the reducing sugars and starch content in the leaves of treatments 4, 5,6and7 were significantly higher than those of the control (T_1).These results agreed with those obtained by Nawar (1982) on some olive varieties. He found a positive relationship between nitrogen fertilization and leaf reducing sugars and starch levels.

The result also indicated that, in both seasons, leaf non-reducing and total sugars contents were not significantly affected by the different studied treatments. These results are in line with those obtained by Haas (1945) who found that more sugars were present in olive leaves collected from orchards where fertilization was not practiced, in comparison with those collected from fertilized ones. The same trend of results was obtained by Sourour (2003). She found that the combination between nitrogen and potassium fertilization

did not cause significant effect on leaf non reducing and total sugars content for Picual and Chemlali olive.

Table (4): Effect of soil application with nitrogen and potassium on leaf carbohydrate content of olive trees, 2000 and 2001.

Treatments	Reducing Sugars		Non-Reducing sugars		Total Sugar %		Starch %		Total Carbohydrates %	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
T_1	1.25	1.34	1.39	1.49	2.64	2.83	4.00	3.65	6.64	6.48
T_2	1.25	1.36	1.44	1.51	2.69	2.87	4.04	3.75	6.73	6.62
T_3	1.27	1.37	1.44	1.53	2.71	2.90	4.08	3.97	6.79	6.87
T_4	1.30	1.41	1.49	1.56	2.79	2.97	4.10	4.04	6.89	7.01
T_5	1.35	1.46	1.53	1.61	2.88	3.07	4.13	4.10	7.01	7.17
T_6	1.35	1.48	1.57	1.63	2.92	3.12	4.15	4.20	7.07	7.32
T_7	1.40	1.54	1.58	1.69	2.98	3.23	4.17	4.25	7.15	7.48
$L.S.D._{0.05}$	0.04	0.05	N.S	N.S	N.S	N.S	0.10	0.33	N.S	0.41

The data in Table (4) also showed that the application of various rates of N and K generally, increased the concentration of total carbohydrates in the leaves. Significant differences were found only between the control and each of T_4 (1.5 kg ammonium nitrate + 0.5 kg potassium sulphate), T_5 (1.5 kg ammonium nitrate + 1.0 kg potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) in second season. These results are in agreement with those observed by Nawar (1982) working on some olive cultivars. He found a positive relationship between nitrogenous fertilization and the leaf total carbohydrates contents. This increment was attributed to a temporary increase in the photosynthetic rates after heavy nitrogen application, (Nijjar, 1985). On the other hand, Sourour (2003) found that K and N combinations had no significant effect on leaf total carbohydrates.

4- Effect of soil application with nitrogen and potassium on fruit set, fruit weight/tree and number of flowers per inflorescence:

Data in Table(5) clearly showed that the studied treatments, tended to increase number of flowers per inflorescence as compared with the control but the differences were only significant for T_5 (1.5 kg ammonium nitrate + 1.0 kg potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate). The apparent increase in the number of flowers born on each inflorescence might be looked upon as a direct effect of nitrogen fertilization on the inflorescence length. It seems more probably that adequate nitrogen in conjunction with sufficient carbohydrates during the critical periods of inflorescence formation and flower differentiation would stimulate greatly the potential size of an inflorescence and concurrently increases its flower

number. The results of Hartmann (1958), as well as Hackett and Hartmann (1964) may support this conclusion.

Data concerning the effect of nitrogen and potassium fertilization on fruit set and yield expressed as fruits weight/tree (Kg) are listed in Table (5).The present results indicated that the studied treatments, tended to increase fruit set percentage as compared with the control, but the differences were only significant for T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) treatments. These results are in agreement with those obtained by Cimato *et al.* (1990), Amit Jasrotia *et al.* (1999) and Sourour (2003). They found that nitrogen and potassium fertilization increased fruit set and reduced fruit drop.

The results also revealed that in both seasons T_5 (1.5 kg ammonium nitrate + 1.0 kg potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) increased fruit weight/ tree when compared with the control. These results are similar to those obtained by Velasco *et al.* (1965), Vlasic (1968), Klein and Lavee (1977), Nurberdyev *et al.* (1983), Cimato *et al.* (1990), Marcelo and Jordao (1994) and Amit Jasrotia *et al.* (1999). On the other hand, Sourour (2003) found that the effect of combinations between nitrogen and potassium did not appreciably change the amount of yield in olive cultivars.

Table (5): Effect of soil application with nitrogen and potassium on fruit set, number of flowers / inflorescence and fruit weight / tree of Chemlali olive trees, 2000 and 2001.

Treatments	Fruit set %		No. of flowers / Inflorescence		Fruits weight/ tree (kg)	
	2000	2001	2000	2001	2000	2001
T_1	5.00	6.40	12.65	12.98	14.71	15.78
T_2	5.15	6.50	12.85	13.00	14.75	16.00
T_3	5.17	6.56	13.00	13.22	15.25	16.20
T_4	5.26	6.68	13.32	13.35	15.48	16.23
T_5	5.45	7.00	15.55	15.85	18.13	18.90
T_6	8.38	8.37	17.95	17.90	19.64	20.00
T_7	8.50	9.05	18.00	18.15	20.55	21.00
$L.S.D._{0.05}$	0.53	0.68	1.12	0.78	0.79	0.69

5- Effect of soil application with nitrogen and potassium on fruit quality of olive trees:

a- Fruit weight, length, diameter, seed weight, flesh weight and flesh percent:

It could be stated from the data in Table (6) that the length of the control fruit T_1 was significantly lower than that in T_5 (1.5 kg ammonium nitrate + 1.0 kg

potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) in both seasons. On the other hand, Sourour (2003) found that the application of nitrogen and potassium fertilization caused a significant decrease in fruit length of Chemlali olive trees. The results also showed that T_5 (1.5 kg ammonium nitrate + 1.0 kg potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) , in the second season, significantly decreased fruit diameter as compared with T_1. Similar results were found by Sourour (2003) who found that fruit diameter was significantly decreased as affected by the interaction between nitrogen and potassium fertilization. However, Loupassaki *et al.* (1993) working on Manzanillo trees, found that fruit shape was not affected by any of the nitrogen and potassium fertilizer treatments.

It is clear from the data in Table (6) that combined application with nitrogen and potassium treatment were very effective in improving fruit weight of olive trees , the differences were significant between all treatments and the control except T_2 (1.0 Kg ammonium nitrate + 0.5 kg potassium sulphate). The results are in line with those obtained by El-Tomi *et al.* (1966), Fandi (1987), Haggag (1996) and Amit Jasrotia *et al.* (1999). However, Loupassaki *et al.* (1993), Marcelo and Jordao (1994) and Sourour (2003) reported that no significant effect of either nitrogen or potassium application rates were observed on mean fruit weight.

Table (6): Effect of soil application with nitrogen and potassium on fruit physical properties of Chemlali olive trees, 2000 and 2001.

Treatments	Fruit weight (gm)		Fruit diameter (cm)		Fruit length (cm)		Seed weight (gm)		Flesh weight (gm)		Flesh %	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
T_1	1.00	1.06	1.07	1.18	1.25	1.25	0.31	0.34	0.69	0.72	69.00	67.93
T_2	1.05	1.13	1.07	1.15	1.26	1.27	0.31	0.34	0.74	0.79	70.48	69.92
T_3	1.15	1.20	1.05	1.13	1.28	1.27	0.31	0.33	0.84	0.87	73.05	72.50
T_4	1.24	1.30	1.05	1.13	1.35	1.33	0.30	0.33	0.94	0.97	75.81	74.62
T_5	1.35	1.36	1.05	1.01	1.45	1.44	0.30	0.31	1.05	1.05	77.78	77.21
T_6	1.44	1.45	1.04	0.95	1.45	1.45	0.28	0.31	1.16	1.14	80.56	78.62
T_7	1.53	1.55	1.04	0.90	1.54	1.52	0.26	0.31	1.27	1.24	83.01	80.00
$L.S.D_{0.05}$	0.09	0.09	N.S	0.06	0.13	0.09	N.S	N.S	0.27	0.22	7.38	9.64

Data in Table (6) clearly show that significant increase in flesh weight (gms) and flesh-fruit percentage were observed, when trees were soil applied with T_5 (1.5 kg ammonium nitrate + 1.0 kg potassium sulphate), T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium

nitrate + 1.0 kg potassium sulphate) in both seasons except T_4 (1.5 kg ammonium nitrate + 0.5 kg potassium sulphate) in second season. The results are in line with those obtained by Marcelo and Jordao (1994) who found that fruit quality was significantly affected when the tree received NK. On the other hand, El-Tomi *et al.* (1966), Loupassaki *et al.* (1993) and Sourour (2003) found that flesh weight and flesh-fruit percentage were not greatly affected by fertilization.

In both experimental seasons, the difference in seed weight was not high enough to be significant between the different fertilization treatments. The results are in line with those obtained by Nawar (1982) and Sourour (2003).

b- Oil percent and moisture percent:

Data concerning the effect of nitrogen and potassium fertilization on moisture percent and oil percent are listed in Table (7).

The present results indicated that, in both seasons, the studied treatments, tended to increase oil percent as compared with the control, but the differences were only significant for T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7 (2.0 kg ammonium nitrate + 1.0 kg potassium sulphate) treatments. These results are in harmony with those obtained by Nawar (1982), Loupassaki *et al.* (1993), Haggag (1996) and Amit Jasrotia *et al.* (1999). However, El-Tomi *et al.* (1966), Fandi (1987), Marcelo and Jordao (1994), Fernandez-Escobar and Marin (1999) and Sourour (2003), found that there were no statistical differences between soil application of nitrogen and/or potassium on fruit oil content.

The epparent increase in oil percentage of olive fruit harvested from fertilized trees might be attributed to the high carbohydrates level manufactured under these conditions. Thus, more amounts of carbohydrates would be probably directed towards the fruits and synthesized into oil. Katajure and Narasaki (1954), Chrysocheris (1961) and Bacha (1970) noticed a relationship between oil accumulation and carbohydrate content in olives. Moreover, Abd-El Messeih (1966) reported that girdling increased the oil content of Chemlali olive fruits, while defoliation decreased it, markedly. These findings may strongly support such interpretation.

Table (7):Effect of soil application with nitrogen and potassium on fruit chemical properties of Chemlali olive trees, 2000 and 2001.

Treatments	Oil %		Moisture %	
	2000	2001	2000	2001
T_1	67.49	66.55	55.00	54.34
T_2	67.89	67.90	56.38	55.94
T_3	68.00	68.05	58.44	58.00
T_4	68.20	68.15	60.00	59.70
T_5	69.50	69.13	62.22	60.77
T_6	69.95	70.00	64.45	62.89
T_7	70.00	70.32	66.41	64.00
$L.S.D._{0.05}$	2.22	3.44	8.17	6.45

In both experimental seasons, the difference in fruit moisture percent was high enough to be significant between the control and both of T_6 (2.0 kg ammonium nitrate + 0.5 kg potassium sulphate) and T_7. Similar result was found by Nawar (1982) who reported that nitrogen application tended to decrease the moisture percentage of olive fruits. However, Sourour (2003) found that nitrogen and potassium fertilization had no effect on fruit moisture percent.

REFERENCES

Abd El-Messeih, M.N. (1966). Studies on flowering and fruiting in olives. M. Sc. Thesis, Alexandria University.

Ahmed, F. F and M. A. Ragab (2002). A new trial to simulate growth and nutritional status of Picual olive transplants. The First International Conference on Olive Cultivation, Protection and Processing, 25-27, Sept. El. Arish Egypt. pp. 19-35.

Al-Saket, I. A. (1987). A preliminary study on the effect of foliar urea spray on the yield, oil percentage and nitrogen content of Koratena olive cultivar. Dirasat , 14(2): 19-31.

Amit Jasrotia, R.P. Singh, J.M. Singh and V.P. Bhutani (1999). Response of olive trees to varying levels of N and K fertilizers. Acta Hort. 474: 337-340. (Hort. Abst. 1999, vol. 69(11): 9975).

Arquero O.; D. Barranco; C. Navarro and De C. Toro (2000). Use of monopotassium phosphate as leaf fertilizer for olive. The fourth International Symposium on olive growing (Olive 2000). Valenzano Italy, 25-30 Sept., p. 60.

Association of official agricultural chemists (1950). Official methods and tentative methods of analysis. 7th Ed., P.910, Washington, D.C., U.S.A.

Association of official agricultural chemists (1980). Official methods of analysis. 4th Ed. Association of official analytical chemists. Washington, D.C., U.S.A.

Bacha, M.A.A. (1970). Seasonal changes in carbohydrates, total nitrogen and oil content in some olive varieties. Ph.D. Thesis, Alexandria Universty.

Bailey, L. H. (1961). The standard Cyclopedia of Horticulture. Vol 11: 1414-1415.

Bar-Akiva, A. (1974). Nitrate estimation in citrus leaves as means of evaluating nitrogen fertilizer requirement of citrus trees. International Citrus Congress, 1; 159-164.

Blevins, D. G. And K. M. Lukaszewski (1998). Boron in plant structure and function. Annu. Rev. Plant Physiol. Plant mol. Biol., 49: 481-500.

Bremner, J. M. (1965). Inorganic forms of nitrogen. Methods of soils Analysis (2), Amer. Soc. Argon, Madison, Wisconsin. (C.F. Black *et al.*, P. 1179-1237).

Chrysocheris, L. (1961). Studies on the physiology of the olive fruit in the olive variety Koroneici (growth and eleogensis). Cairo edible fats and oils symposium. Faculty of Agr. Cairo Univ. (April, 1961).

Cimato, A., M. Marranci and M. Tattini (1990). The use of foliar fertilization to modify sinks competition and to increase yield in olive *(Olea europaea cv. Frantoio)*. Acta Horticulturae 286: 175-178.

Connell, J. H.; L. Ferguson; W. H. Krueger: G.S. Sibbett; P. D. Metheney and H. Reyes (2000). Effect of foliar applications of urea on olive leaf nitrogen, growth and yield. The fourth International symposium on Olive growing (olive 2000), Valenzano. Italy, 25-30 Sept., p.19.

El-Sharkawy, S. M. (1999). Physiological studies on flowering and fruiting of trees. Ph. D. Zagazeeg University.

El-Sisy, W. A. (2001). Response of guava trees to some irrigation and fertilization treatments. Ph.D. Thesis, Fac. Of Agric., Univ. of Alex. Egypt.

El-Tomi, A. L., M. A. M. El-Mohadi and G. M. Nour (1966). Effect of nitrogen fertilization on productivity of Chemlali olive tree at Burg El-Arab area-Extrait du Bulletin de L'Istitut du Desert d'Egypte.

Evenhuis, B. (1976). Nitrogen determination. Dept. Agric. Res., Royal. Tropical Inst., Amstredam.

Evenhuis, V. and P. W. DeWaard(1980). Principles and practices in plant analysis. FAO soils Bull. 38(1):152-163.

Fandi, N. M. (1987). Effect of foliar fertilization, Chemical fruit thinnig and supplemental irrigation on growth and fruiting of the "Nabali" olive. Dirasat 14(2): 177-178. (Hort. Abst. 1989, vol. 59(5): 4385).

Fernandez-Escobar, R. and L. Marin (1999). Nitogen fertilization in olive orchards. Acta Hort. 474: 333-335. (Hort. Abst. 1999, vol. 69(11):9974).

Ferreira, J.; M. Pastor and M. Magallanes (1980). Trials on foliar nitrogen fertilization in olive. Olea, December, 7-23 (C. F. Hort., Abst., 52: 5799).

Haas, A. R. C. (1945). Boron content in almond, olive and walnut trees. Proc. Amer. Soc.ort. Sci. 46: 69-77.

Hackett, W. and H. T. Hartmann (1964). Inflorescence formation in the olive as influenced by low-temperature, photoperiod and leaf area. Bot. Gaz., 125(1): 65-72.

Haggag, L. F. (1996). Response of Picual olive trees in sandy soil to various forms of N fertilization (organic and chemical). Annals of Agric. Sci. 41(1):313-319. (Hort. Abst. 1997, vol. 67(7):6426).

Hartmann, H. T. (1958). Some responses of the olive to nitorgen fertilizers. Proc. Amer. Soc. Hort. Sci. 72:257-66.

Hartmann, H. T. and P. Papaioannou (1971). Olive varieties in California. Calif. Agric. Exp. Stn. Bult. 720.

Jackson, M. L. (1967). Soil Chemical Analysis. Hall of India Private. New Delhi, India.

Jordao, P. V., J. C. S. Dias, F. Calouro and M. L. Durate(1994). Effect of fertilization on the leaf macronutrient concentrations of olive tree. Acta Horticulturate No. 356, 197-201. (Hort. Abst. 1995, vol. 65(12):11136).

Katajura, K. and T. Narasaki (1954). Fundamental studies on the utilization of olive fruits. I-Changes in composition during maturation. Tech. Bull. Kagawa agric. Coll., 6: 1-7. (Hort. Abst., 26: 1054).

Kilany, O. A. and, A.E. Kilany (1990). Effect of nitrogen fertilization on growth, flowering, fruit quality and leaf nitrogen status of Picual olive trees. 3th conf. Agric. Dev. Res., Fac. Agric., Ain Shams Univ., Cairo, Egypt, December 22-24, 1990. Annals of Agric. Sci. Cairo, Special Issue, 585-595.

Klein, I. and S. Lavee (1977). The effect of nitrogen and potassium fertilizers on olive production. C. R. 13th coll. Int. Potash. Inst. York. England. pp. 295-304.

Klein, L. and S. A. Winbaum (1985). Foliar application of urea to almond and olive: leaf retention and kinetics of uptake. J. Plant Nutrition, 8(2): 117-129.

Loupassaki, M. H., S. Perica and I. I. Androulakis (1993). Seasonal changes in the olive fruit and the effects of summer applied nitrogen and potassium. Advances in Horticultural Science 7(2):65-68. (Hort. Abst. 1994, vol. 64(10):1442).

Malik, C. P. and M. B. Singh (1980). Plant enzymology and histoenzymology. A text Manual Kalyoni Publishers, New Delhi, India.

Marcelo, M. E. and P. V. Jordao (1994). Effect of nitrogen and potassium on yield and some fruit quality parameters of olive tree. Acta Hort. 356: 202-204. (Hort. Abst. 1995, vol. 65(12): 11140).

Miao, Q, X. J. Lun and X. Y. Liang (1993). Effects of K fertilization on the contents of nutrient elements in banana leaves. Soils and Fertilizers (Beijing). No. 2, 4-7. (Cited at Hort. Abst., 65(10): 9302).

Murphy, J. and J. P. Riley (1962). A modified single solution method for the determination of phosphorus in natural water. Anal. Chem. Acte. 27:31-36.

Nawar, A. M. (1982). The nutritional status of the tree in relation to flowering and cropping in some olive varieties *(Olea europea L.)*. Ph. D. Thesis, Fac. Fo Agric., Alexandria Univ., Egypt.

Nijensohn, L. and J. A. Maffei (1995). Response of olive trees to fertilization in cruz de piedra, Maipu, Mendoza, and parameters having a diagnostic value.II. Foliar diagnosis: N, P, K. Riego No. 49 (Hort. Abst. 1997, vol. 67(8):7298).

Nijjar, G. S. (1985). Nutrition of Fruit Trees. Mrs Ushe Raji Kumar Kalayani Publishers, New Delhi, Indie, pp. 10-50.

Nurberdyev, M., V. A. Sholokhova and E. N. Domenskaya (1983). Effect of mineral fertilizers on the growth and productivity of olives in south western Tur Kmenia. Subtropicheskie Kul'tury 2: 110-117. (Hort. Abst. 1983, vol. 53(10): 7451).

Perica, A. I. I. Androulakis and M. H. Loupassaki (1994). Effect of summer application of nitrogen and potassium on mineral composition of olive leaves. Acta Hort. 356: 221-224. (Hort. Abst. 1995, vol. 65(12): 11141).

Ragab, M. A. (2002). Importance of potessium, boron and citric acid for obtaining an economical yield of Toffahi olives. The first International Conference on Olive Cultivation, Protection and Processing, 25-27 Spt. El-Arish, Egypt, pp. 36-49.

Snedecor, G. W. and W. G. Cochran (1990). Statistical Methods. 7th edition, Iowa State Univ. Press, Ames, Iowa, USA. P. 593.

Sourour, M. S. M. (2003). Response of Picual and Chemlali olive trees, grown under two levels of irrigation to NK fertilization. Ph. D. Thesis, Fac. of Agric., Univ. of Alex.

Velasco, E. E., A. J. Oliveria and M. L. Barros (1965). Mineral fertilization of olives in the province of Grande. Results of seven years trial. Agronomica Lusit., 27: 103-22 (Soils and fertilizers, 30: 3904).

Vlasic, A. (1968). Nitrogen fertilization of olives on gravelly soil. Jugoslov. Vocarstvo., 2: 17-26. (Hort. Abst., 39: 7445).

Woodman, A. G. (1941). Food Analysis. Mc Graw-Hill Book Company, Inc., New York U.S.A.

تأثير اضافة جرعات من النيتروجين و البوتاسيوم على محتوى الأوراق من العناصر و عقد الثمار و المحصول و جودة ثمار أشجار الزيتون "شملالى" النامية فى أرض رملية.

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أجريت هذه الدراسة عامى ٢٠٠٠و٢٠٠١ لدراسة تأثير اضافة جرعات مختلفة من نترات الأمونيوم و كبريتات البوتاسيوم على أشجار الزيتون شملالى و ذلك لدراسة تأثيرها على المحتوى المعدنى للأوراق، نسبة عقد الثمار، المحصول و جودة الثمار و أوضحت النتائج ما يلى:-

- أدت المعاملة الخامسة (١,٥ كجم نترات أمونيوم + ١ كجم كبريتات بوتاسيوم) و السادسة (٢ كجم نترات أمونيوم + ٠,٥ كجم كبريتات بوتاسيوم) و السابعة (٢ كجم نترات أمونيوم + ١ كجم كبريتات بوتاسيوم) الى زيادة نيتروجين الأوراق و المحصول و عدد الأزهار فى النورة و طول الثمار خلال عامى الدراسة. و أيضا نتج عنها زيادة فى وزن اللحم و نسبة اللحم فى الثمار فى الموسم الأول و كذلك أدت الى زيادة بوتاسيوم الأوراق فى الموسم الثانى من الدراسة بينما لم يتأثر تركيز الفوسفور و السكريات الغير مختزلة و السكريات الكلية خلال عامى الدراسة نتيجة للمعاملة.
- أدت المعاملة السادسة و السابعة الى زيادة نسبة عقد الثمار و النسبة المئوية للزيت و النسبة المئوية للرطوبة فى الثمار.
- كذلك أدت المعاملات الرابعة (١,٥ كجم نترات أمونيوم + ٠,٥ كجم كبريتات بوتاسيوم) و الخامسة و السادسة و السابعة الى زيادة السكريات المختزلة فى الأوراق و الثمار فى كلا الموسمين. كما أدت جميع المعاملات الى زيادة فى وزن اللحم و النسبة المئوية للحم و الكربوهيدرات الكلية فى الموسم الثانى فقط.
- كما أدت جميع المعاملات ما عدا المعاملة الثانية (١ كجم نترات أمونيوم + ٠,٥ كجم كبريتات بوتاسيوم) الى زيادة معنوية فى وزن الثمار و محتوى الأوراق و الثمار من النترات.