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MAXIMIZING THE PRODUCTIVITY OF OLIVES BY USING SOME MATERIALS AND ITS IMPACTS ON THE QUALITY INDICES OF PICUAL OLIVE OIL

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ABSTRACT : *The objective of this work was study that the effect using one treatment of (Girdling at first week of January and Kaolin sprayed at rate 5% mid December) and chemical (Calcium carbonate, sprayed at rate 5% mid December, Naphthalene acetic acid at 100ppm mid December and Boric acid (17.50%) at 300ppm in first week of March) on oil yield, quality indices, minor components and fatty acids composition of olive Picual cv. during seasons 2012-2013. Yield/tree, fruit weight, seed weight, flesh weight, flesh/fruit weight, flesh/stone, moisture and oil contents (%) were determined. Quality indices (acid value, peroxide value, absorbance at K_{232}nm, K_{270} nm and Δk, value), sensory evaluation, total polyphenol, tocopherol, bitter index at K_{225}, pigments content, oxidative stability by Rancimat method at 100°C, and Fatty acid composition by GC of virgin olive oil extracted from Picual variety were determined. Results indicated that the treated tree (Picual cv.) by Girdling, Boric acid, Naphthalene acetic acid and Kaolin gave a higher content in oil percentage/tree. Also, same the treatments gave best values in quality indices, total polyphenol, tocopherol and oxidative stability compared with untreated and treated samples with calcium carbonate. On the other hand, the treated trees by Girdling, Boric acid, Naphthalene acetic acid and Kaolin surpassed on untreated and treated samples with- calcium carbonate in oleic acid levels. Generally, can be used (Girdling, Boric acid, Naphthalene acetic acid and Kaolin) to increase the productivity of olive trees Picual cv. and also improve the quality attributes of the oil extracted. Also these treatments increased the oleic acid more than untreated sample.*

Key words: *Picual cultivar, oil content, Fatty acid composition, polyphenols, oxidative stability.*

INTRODUCTION

Olive "*Olea europaea*, L." is one of the most important fruit crops in Egypt since it cultivated in a big area and ranks the fourth place among the fruit crops. The Picual variety is one of the most important commercial olive varieties which can be used for pickling, oil extraction or for the double purposes. Under sandy soil conditions, olive plants gave low yield especially in the newly reclaimed areas such as sides of the desert roads, Sinai and the north western coast El-Badry (2012).

The olive tree is one of the most important crops in the Mediterranean countries. The origins of the cultivation of the olive tree lie rooted in legend and tradition. It probably started about 5000-6000 years ago within a wide strip of land by the eastern Mediterranean sea and in the adjacent zones comprising Asia minor, part of India, Africa, and Europe Muzzalupo and Perri, (2008). Others believe that the olive tree originated from Africa (Ethiopia, Egypt). This is where olive trees were first cultivated systematically, and from where they spread to Cyprus, Morocco, Algeria, Tunisia and to western places by the Phoenicians (Loukas and Krimbas, 1983). As a matter of fact, olive tree is naturally characterized with alternate bearing habit as it tends to gain alarge crop in one year and a very little crop in the following year (Daood, 2002)

The growth regulators have been intensively and extensively applied for agriculture production, and played a vital role in the growth and development of plants. Along with the development of intensive cultivation of fruits, applications of regulators for controlling the growth of fruits have been progressively paid more attention (Ma and Liu, 1998). Growth regulators such as gibberellic acid (GA3) and naphthalene acetic acid (NAA) significantly increased fruit weight and size of some date cultivars (Mohammed and Shabana, 1980) and of several other fruit types (Faust, 1989 and Westwood, 1993) possibly by increasing cell size and/or cell numbers.

Olive tree belongs to the family Oleaceae. It can thrive and produce in the new reclaimed areas where other crops can't grow. Besides, nutritional importance of olive fruits, either as table olive or for olive oil production. Olive crop is considered a strategic significant crop in reclaimed lands that achieve highly expensive either in local or in foreign markets. In addition, olive offers a great economic potential. Olive production plays an important role in the economy of many Mediterranean countries. Hence, olive trees areas increased rapidly in Egypt and reached about 155824 Fadden, with total production about 459650 tons, where 20% of the total fruit production produces about 10000 tons of olive oil, but there are many areas affected with productivity reduction (SMA, 2006-2011). It is the problem of planted olives areas (productivity reduction). This habit causes severe loss for olive grower's income expressed in disturbances in yearly income of the orchard and poor fruit quality (Goldschmidt, 2005). Environmental conditions play an important role in growth and productivity of olives kinds as productivity varies according to environmental and climate conditions (Lavee, 1989). Studies concerning environmental conditions influenced olive trees behavior (Lavee, 2007), especially its bearing habit, yield and fruit quality are still of need for further studies. Previous studies indicated that flower initiation in olive trees needs winter chilling requirements as well as for maximum flowering. On the other hand, high temperatures (over 30°C) during blooming period induced reduction of fruit set in olive Cvs. (Pinney and Polito, 1990). Consequently, using spray of some materials (Kaolin and Calcium Carbonate) over tree canopies for studying impact of these coefficients on alleviating direct solar radiation and reducing temperature in a trial to provide a part of chilling requirements of trees Saour and Makee (2003). Girdling has been reported to enhance the percentage of perfect flowers through increasing carbohydrate reserves (Abo-Taleb, 1998). On the other hand, naphthalene acetic acid (NAA) have been reported to enhance flowering and fruit setting when they applied at low concentration at mid December and. Too, boric acid (H_3BO_3) have been reported to enhance fruit setting when they applied at low concentration at full bloom.

Olive oil is obtained from the fruit of olive trees and is a genuine fruit juice with excellent nutritional, sensorial and functional properties. Today, its biological, nutritional and healthful effects are universally acknowledged (Morcello *et al.,* 2005). Olive oil quality is influenced by a great number of factors among which the geographical production area(altitude, soil composition, latitude), the cultivar chosen, Growth regulators types and concentration, the harvest period and extraction procedure, as well as the climatic conditions prevalent in the year of production (Ben Temime *et al.,* 2006; and Bacccouri *et al.,* 2007). During the ripening, several metabolic processes take place in olives with subsequent variations on profiles of some compounds and effect on plant physiologic behavior and, consequently, on chemical characteristics of its oil (Moussa and Gerasopoulos 1996; and Ryan *et al.,* 1998). These changes are reflected on the quality grade, sensorial characteristics, oxidative stability and nutritional value of the obtained product. The International Olive Council (IOC, 2009), and the European Commission (EC, 1991) have defined the quality of olive oil based on parameters that include free acidity, peroxide value (PV), UV specific extinction coefficients (K232 and K270) and sensory score. In particular, the quantity of free

acidity is an important factor for classifying olive oil into commercial grades (Boskou, 1996). The general classification of olive oils into the different commercial grades is based on free acidity and sensory characteristics (taste and aroma). The commercial grades separate oil obtained from the olive fruit solely by mechanical or physical means (virgin) from the other oils that contain refined oils Kalua *et al.,* (2007). Zeitoun *set al.,* (1991) mentioned that oleic acid was present as major fatty acid of olive oil and its percentage ranged from 66.40% to 78.30% followed by linoleic from 6.10% to 13.30%, palmitic acid from 8.80% to 15.20%, palmitoleic from 0.00 to 1.70% and stearic acid from 2.40% to 3.40% and other fatty acids (C14:0, C17:1, C18:3, C20:0, C20:1 and C22:1) represented from 0.00 to 1.00% of the oil fatty acid composition. The contribution of phenolic components to the shelf life of olive oil has been investigated for more time and the relationship between the oxidative stability of the oil and their concentration is well established. Although, polyphenols are also responsible for the olive oil tastes (Gutierrez *and* Fernandez, 2002). The tocopherol in virgin olive is important for their nutritional value and for their antioxidant properties, in that they protect the fat components from autoxidation. They constitute the lipophilic antioxidant group and are noted for their effective inhibition of lipid oxidation in all vegetable oils. α-tocopherol, the most important antioxidant accounts for about 95% of the total tocopherol in virgin olive oil (Aguilera *et al.,* 2005). The minor components (phenolic compounds and α tocopherol) of olive oil are affected by the cultivar, soil, climate, system of irrigation, ripeness degree and processing methods (Morello *et al.,* 2004).

The present study was conducted to study using some materials (calcium carbonate, kaolin, naphthalene acetic acid, girdling and boric acid) and their effects on oil content and quality indices of virgin olive oil extracted from Picual cultivar.

MATERIALS AND METHODS

Materials:

- ***Source of olive fruits***: This work was conducted throughout two successive seasons of (2011-2012 and 2012-2013) on 15-years-old "Picual" olive trees. The trees were raised by cuttings and, planted at 6X6 m. (120 trees/fed) apart in a sandy soil of a great private orchard at AL-Khatatba, Minufiya Governorate, Egypt at 30.6N latitude, 31.01 S longitudes, at an elevation of 17.9 m above sea level, owned by Mr. Fouad Cheeded. All fruits were collected by hand at the mid. November during the crop season (2011-2012 and 2012-2013). Only healthy fruits, without any kind of infection or physical damage were processed.
- ***Treated Picual olive tree:*** The Picual olive trees were treated with either of the following treatments. Treatments consisted of control, spray of calcium carbonate at 5%, kaolin at 5%, naphthalene acetic acid at 100ppm, girdling and boric acid at 300ppm respectively. Girdling was done once in first week in January at seasons 2011/2012 and again in 2012/2013. For girdling 5 mm wide bark at the base of the 1.5 m height/main branch from all around was removed without injuring the wood with sharp knife (Table 1).

Table 1: Treatments of Picual cv. olive trees.

Treatments		Date of application
Control (untreated)	(C)	
Spraying Calcium carbonate by rate of 5% ($CaCo_3$).	(CAC)	Mid. December
Spraying by rate of 5% (Kaolin)	(K)	Mid. December
Spraying Naphthalene acetic acid at 100ppm	(NAA)	Mid. December
Girdling	(G)	First week of January.
Boric acid (H_3Bo_3, 17.5%B) at 300ppm	(BA)	First week of March.

- ***Reagents, solvents and standards:*** All solvents in this study were purified and distilled before use. Folin-Ciocalteau reagent was obtained from Gerbsaure Chemical Co. Ltd., Germany. α- tocopherol and Gallic acid standards were obtained from Koch Light Laboratories Ltd. England.

Methods:

- ***Oil extraction:*** After harvest, fresh olives (1.5-2.0 kg) were deleafed and washed, crushed with mill and pressed using hydraulic laboratory (Carver) press. Oil produced from each extraction was filtered and then transferred into dark glass bottles and stored in the dark at 4°C until analysis.

- ***Quality parameters:*** Acidity, peroxide value and UV absorption characteristics, K_{232nm} (conjugated dienes) and K_{270nm} (conjugated trienes) were carried out following the analytical methods described by IOC (2009). ΔK values were calculated according to the followed equation:

$$\Delta K = K_{270} - K_{266} + K_{274}/2 \quad (1)$$

- ***Oil stability:*** Oxidative stability was evaluated by the Rancimat method (Gutierrez, (1989). Stability was expressed as the oxidation induction time (h), measured with the Rancimat 679 apparatus (Metrohm Co., Herisou, Switzerland), using an oil sample of 5.00 g heated to 100°C ± 2°C with an air flow of 20 l/hr^{-1}.

- ***Total phenolic content:*** Phenolic compounds were isolated by triple extraction of a solution of oil (10g) in hexane (20ml) with 30 ml of a methanol-water mixture (60:40, v/v). The Folin-Ciocalteau reagent was added to a suitable aliquot of the combined extracts, and the absorption of the solution at 725nm was measured. Values are given as milligrams of Gallic acid per kilogram of oil (Gutfinger, 1981).

- ***Total tocopherol content:*** The total tocopherol content in oils was determined according to the method of Wong *et al.*, (1988).

- ***Pigment content:*** Chlorophyll and carotenoid compounds (ppm) were determined at wave length of 670 nm and 472nm, respectively, in cyclohexane using the specific extinction values, by the method of Minguez-Mosquera *et al.*, (1991).

- ***Bitter index:*** Bitter index was evaluated by extraction of the bitter compounds from the olive oil samples. One gram ± 0.01 g oil sample was dissolved in 4ml hexane and passed through C18 column (Sep-Pack Cartridges, water, Milford MA), previously activated with methanol and washed with hexane (6 ml). After, 10ml of hexane was passed through to eliminate fat, and then the retained compounds were with methanol/water (1:1) to 25ml (Gutierrez *et al.*, 1992). The absorbance of the extract was measured at 225nm against methanol/ water (1:1) in a1cm cuvette.

- ***Fatty acids composition:*** The fatty acid of the analyzed oil samples was determined by GC-Capillary column according to the method reported by IOC (2009).

- ***Organoleptic test:*** The organoleptic test was determined for the extracted oil according to the International Olive Council (IOC, 2009). The oil samples (15 ml) were presented in covered blue glasses (diameter, 70 mm, capacity, 130 ml) at 28°C ± 2°C. The glass warmed and after removing the cover, the samples were smelled and then tested by the panelist to judge its flavor. The different attributes of the oils were assessed and their intensities were evaluated as a mean value of the panelists score.

- ***Statistical analysis:*** The results are reported as the mean values. Data were compared on the basis of standard deviation of the mean values. In addition, Duncan's multiple range tests were used

to determine significant differences among data. Statistical analysis was performed using the Statistical 5.00 Package (Stat Soft 97 edition).

RESULTS AND DISCUSSION

Chemical composition of olive fruits:

From the results in Table (2) illustrated that the effect of some treatments: untreated (C), treated with calcium carbonate (CAC) at 5% in mid. December, kaolin (K) at 5% in mid. December, naphthalene acetic acid (NAA) at 100ppm in mid December, girdling (G) at first week in January and boric acid (BA) at first week of March on chemical composition of olive fruits (Picual cv.). Data in Table (2) showed that the untreated olive tree (Picual cv.) gave 35.00 kg/tree in season 11/12, but decrease this amount to 25kg/tree in season 12/13. While, the olive tree treated with (K) gave a higher yield (55kg/tree) in season 11/12. But the treated olive tree with (G) gave a higher yield (42kg/tree) in season 12/13. Generally, the treated olive trees (Picual cv.) by some materials were significantly increased in yield fruits/tree compared to the control. These results were in agreement with those obtained by Lavee, (2007) and Burme *et al.*, (2011).

Table 2: Effect of some materials spray on yield/tree, fruits weight, flesh weight, flesh/stone, fruit moisture and fruits oil in Picual Cv. during years 2011/2012 and 2012/2013.

Parameters		Treatments					
		(C)	(CAC)	(K)	(NAA)	(G)	(BA)
Yield kg/tree	11/12	35.00±3.020	50.00±4.90	55.00±5.20	43.00±3.13	50.00±4.12	43.00±3.41
	12/13	25.00±2.10	35.00±2.13	40.00±3.89	35.00±2.91	42.00±3.51	36.00±2.18
	Means	30.00±2.90	42.50±4.16	47.50±4.53	39.00±2.61	46.00±3.80	39.50±2.51
Fruit weight	11/12	5.12±0.81	6.05±0.66	6.30±0.51	6.26±0.48	6.12±0.45	6.22±0.51
	12/13	6.18±0.90	8.01±0.98	8.38±0.69	9.58±0.95	7.86±0.69	9.70±0.98
	Means	5.65±0.57	7.03±0.73	7.34±0.74	7.92±0.84	6.99±0.81	7.96±0.63
Seed weight	11/12	0.88±0.10	0.90±0.18	0.97±0.09	0.75±0.03	0.86±0.10	1.00±0.15
	12/13	0.82±0.09	1.09±0.20	0.95±0.11	0.95±0.10	0.92±0.15	1.08±0.13
	Means	0.85±0.10	0.99±0.13	0.96±0.10	0.85±0.10	0.89±0.11	1.04±0.10
Flesh weight	11/12	4.00±0.71	5.20±0.69	5.28±0.43	5.50±0.46	5.27±0.44	5.23±0.41
	12/13	5.40±0.85	6.92±0.75	7.44±0.91	8.62±0.79	6.93±0.71	8.65±0.95
	Means	4.70±0.65	6.06±0.49	6.36±0.59	7.06±0.55	6.10±0.53	6.94±0.66
Flesh/fruit weight	11/12	78.00±6.20	86.00±7.11	85.00±7.33	88.00±9.40	92.00±8.50	84.00±7.20
	12/13	87.00±7.10	86.00±8.10	89.00±8.19	90.00±9.91	88.00±8.12	88.00±8.30
	Means	82.50±7.00	86.00±6.66	87.00±9.10	89.00±8.12	90.00±8.90	86.00±8.11
Flesh/stone	11/12	3.64±0.55	5.78±0.45	5.44±0.40	7.34±0.81	6.12±0.51	5.22±0.49
	12/13	6.58±0.90	6.35±0.61	7.90±0.81	8.98±0.90	7.46±0.66	8.02±0.77
	Means	5.12±0.73	6.06±0.59	6.76±0.50	8.16±0.73	6.79±0.59	6.62±0.47
Fruit moisture (%)	11/12	62.60±5.10	71.61±6.42	69.56±5.22	69.31±5.90	70.26±6.22	67.39±5.33
	12/13	68.80±5.65	70.13±7.52	70.40±6.14	69.23±5.85	70.80±5.89	67.37±6.14
	Means	65.70±5.30	70.87±6.31	69.98±5.20	69.27±6.11	70.53±7.03	67.38±6.83
Fruit oil (%) D.W	11/12	45.10±3.70	35.70±2.19	34.00±3.70	40.97±3.20	38.49±2.91	39.41±2.82
	12/13	40.60±2.88	42.60±3.12	37.20±3.29	39.13±2.28	40.95±3.20	45.67±4.10
	Means	42.85±3.19	39.15±3.00	35.60±2.98	40.05±3.12	39.72±2.19	42.54±4.00

The data (values ± SE) are the mean values of three measurements for the same sample.

The fruit weight, seed weight, flesh/fruit weight and flesh/stone were affected by treated olive tree (Picual cv.) compared to control. The treated tree by (BA) and (NAA) increase significantly fruits weight compared to control and other treatments.

But the trees treated by (BA) and (CAC) increased significantly on the seed weight compared to the control and other treatments. While, treated Picual olive tree by (G) and (NAA) had effect high significant on flesh weight, flesh/fruit weight and flesh/stone compared to and other treatments at season 11/12 and 12/13. These results were in agreement with those reported by El-Sayed *et al.,* (2006); Burme *et al.,* (2011); and Khalil *et al.,* 2012).

Data in Table (2) revealed that the treated olive tree (Picual cv.) by (CAC) increased significantly in moisture content (%) followed by olive treated by (G) compared to the control. Whereas the treated (BA) surpassed control and other treatments in moisture content. On the other hand, the higher significant in oil percentage were recorded in tree treated by (BA) in season 12/13 followed by (NAA) season11/12. These results were in agreement with those obtained by Saad El-Din *et al.,* (2010) and Khalil *et al.,* (2012).

Relationship between yield kg/tree and other values:

The tabulated in Table (3) illustrated that the relationship between yield kg/tree with fruit oil percentage, oil/tree (%), oil kg/fedan for olive tree (Picual cv.) treated by (CAC, K, NAA, G and BA) compared with untreated (control) during seasons 11/12 and 12/13.

Table 3: Relationship between yield kg/tree with fruits oil (%), oil/tree (kg) and oil kg/fedan for olive tree (Picual cv.) treated by some materials.

Parameters		Treatments					
		(C)	(CAC)	(K)	(NAA)	(G)	(BA)
Yield kg/tree	11/12	35.00±3.020	50.00±4.90	55.00±5.20	43.00±3.13	50.00±4.12	43.00±3.41
	12/13	25.00±2.10	35.00±2.13	40.00±3.89	35.00±2.91	42.00±3.51	36.00±2.18
	Mean	30.00±2.90	42.50±4.16	47.50±4.53	39.00±2.61	46.00±3.80	39.50±2.51
Fruit oil (%) (w.w)	11/12	16.86±1.23	10.31±0.96	10.34±0.77	12.56±1.09	11.44±0.90	12.85±1.23
	12/13	12.66±0.99	12.72±1.00	11.01±0.78	12.04±0.88	11.96±0.87	14.95±1.76
	Mean	14.76±1.03	11.51±0.87	10.68±1.01	12.30±1.14	11.70±0.96	13.90±1.23
Oil kg/tree	11/12	5.90±0.78	5.16±0.45	5.69±0.36	5.41±0.78	5.72±0.35	5.52±0.33
	12/13	3.17±0.42	4.46±0.33	4.40±0.45	4.21±0.55	4.91±0.33	5.38±0.45
	Mean	4.53±0.33	4.81±0.29	5.04±0.56	4.81±0.43	5.32±0.56	5.45±0.55
Oil kg/fed	11/12	708.00±30.98	619.20±25.86	682.80±28.91	649.20±29.55	686.40±33.54	662.40±35.00
	12/13	380.40±18.43	535.20±21.76	528.00±25.45	505.20±24.15	589.20±23.19	645.60±40.56
	Mean	543.60±22.76	577.20±24.45	604.80±24.14	577.20±20.98	638.40±29.87	654.00±33.76

The data (values ± SE) are the mean values of three measurements for the same sample.

The data in Table (3) allowed that the production of tree affected by treatments under study. The (BA) were recorded a higher significantly of oil production percentage per tree followed by treatment tree by (G) compared with control and other treatments in second season. Also, the treated tree by (G) gave a higher significant in production of oil per fedan followed by (BA) on dry weight. Production of fruit/tree affecting by bearing cycles Ben-Gal *et al.,* (2011). Daood, (2002) reported that the olive tree is naturally characterized with alternative bearing habit as it tends to gain a large crop in one year and a very little in the following year. It is the problem of planted olives areas (productivity reduction). This habit cause's serves loss for olive grower income expressed in disturbances in yearly income of the orchard and poor fruit quality (Goldschmit, 2005). Overcome on the bearing cycles several study use of some growth regulars such as gibberellic acid and naphthalene acetic acid significantly increased fruit weight and size of some date cultivars and also increase cell size and /or cell number (Khalil *et al.,* 2012).

Quality indices:

Virgin olive oil contains about 98 g per 100g of neutral lipids, mainly triglycerides (96-97g per 100g) followed by a small quantity of diglycerids. The quality criteria of the samples analyzed are listed in Table (4).

Table 4: Effect of treated olive (Picual cv.) by some materials on physicochemical properties of virgin olive oil.

Proprieties		Treatments					
		(C)	(CAC)	(K)	(NAA)	(G)	(BA)
Acid value (mg KOH/g oil^{-1})	11/12	0.64±0.10	0.28±0.05	0.15±0.03	0.11±0.001	0.11±0.001	0.11±0.001
	12/13	0.50±0.08	0.30±0.07	0.35±0.05	0.39±0.07	0.43±0.09	0.25±0.02
	Mean	0.57±0.09	0.29±0.03	0.25±0.04	0.25±0.04	0.27±0.03	0.18±0.01
Peroxide value mq:o2/kgoil-1	11/12	3.74±0.33	3.37±0.29	2.86±0.20	2.39±0.15	2.80±0.12	2.92±0.10
	12/13	3.80±0.41	3.11±0.25	3.00±0.23	2.51±0.21	2.40±0.22	2.68±0.19
	Mean	3.77±0.35	3.24±0.31	2.91±0.21	2.45±0.25	2.60±0.31	2.80±0.22
K_{232}	11/12	1.50±0.15	1.30±0.11	1.41±0.12	1.30±0.13	1.53±0.10	1.35±0.11
	12/13	1.60±0.19	1.20±0.13	1.45±0.10	1.30±0.13	1.35±0.09	1.21±0.09
	Mean	1.55±0.16	1.25±0.10	1.43±0.18	1.30±0.13	1.44±0.11	1.28±0.10
K_{270}	11/12	0.09±0.001	0.09±0.001	0.07±0.001	0.07±0.001	0.08±0.001	0.06±0.001
	12/13	0.11±0.001	0.09±0.001	0.07±0.001	0.09±0.001	0.08±0.001	0.04±0.001
	Mean	0.10±0.001	0.90±0.001	0.07±0.001	0.08±0.001	0.08±0.001	0.05±0.001
ΔK	11/12	-0.105±0.00	-0.106±0.00	-0.092±0.00	-0.087±0.00	-0.093±0.00	-0.078±0.00
	12/13	-0.109±0.00	-0.107±0.00	-0.090±0.00	-0.083±0.00	-0.093±0.00	-0.072±0.00
	Mean	-0.107±0.00	-0.106±0.00	-0.091±0.00	-0.085±0.00	-0.093±0.00	-0.075±0.00
Sensory evaluation	11/12	7.10±0.91	7.20±0.83	7.60±0.95	7.90±1.00	8.00±1.12	8.20±1.20
	12/13	7.10±0.91	7.00±0.87	7.40±0.90	8.00±1.02	7.80±0.95	8.00±0.98
	Mean	7.10±0.91	7.10±0.90	7.50±0.89	7.95±1.10	7.90±1.01	8.10±1.13.
Oxidative stability (hr)	11/12	30.00±2.10	30.00±2.10	35.40±3.20	37.20±3.51	35.70±3.12	38.40±3.92
	12/13	27.50±2.09	33.00±2.60	32.60±2.29	36.00±3.42	36.40±3.41	35.00±3.11
	Mean	28.75±2.00	31.50±2.13	34.00±3.00	36.60±3.49	35.80±3.70	34.20±3.01

The data (values ± SE) are the mean values of three measurements for the same sample.

The quality of the olive oil is studied by measuring the characteristics of the absorption bands between 200 and 300nm. These are frequencies related to conjugated dienes and trienes systems. A low absorption in this region is indicative of a high quality extra virgin olive oil, whereas adulterated/refined oils show a greater level of absorptions in this region. K_{232nm} parameter is mainly indicative of the conjugated dienes. Data in Table (4) showed that the minimum and maximum values for the absorbance at 232nm were recorded (1.25) for sample treated by (CAC) and untreated sample (1.55) oil. The absorbance at K_{270}nm, mainly indicative of the conjugated of trienes and of the presence of carbonylic compounds gives the minimum value (0.05) for treated samples by (BA) and the maximum value (0.11) for untreated samples (C). The values recorded at 232 and 270nm for all samples analyzed complied with IOC extra virgin olive oil (IOC, 2009).

Absorption measurements for purity determination were made at 232, 266, 270 and 274nm. The purity of olive oil can be determined from three parameters: Absorbance at $K_{232, 270nm}$ and ΔK. Tabulated data in Table (4) showed that the all values for ΔK lie inside the limits specified for extra virgin olive oil in the standard (IOC, 2009).

Data in Table (4) illustrated that the free fatty acid (% as oleic acid), peroxide value (meq.O_2/kg oil) at means were found in the range 0.18% to 0.57 %, and 2.45 to 3.80 (meq.O_2/kg oil) respectively. The variation of these values may be due to the effect of treatments (CAC, K, NAA, G, and BA) on olive oil quality extracted from Picual olive fruits compared with control. The present results are found to be much greatly lower than the maximum values for human consumption as reported by IOC (2009); Benincasa *et al.,* (2011); and Naor, *at al.,* (2013).

Oxidative stability has no official standard, but it is a useful measurement for comparing the relative stability of different oils, and is therefore considered to be a good tool for evaluating the resistance of olive oil to oxidation.

To do this, the samples is heated and exposed to oxygen to initiate oxidation, and the formation of hydroperoxides is measured, either by titration or electronically (Kiritsakis *et al.,* 2002). The oxidative stability of olive oil samples treated by (CAC, K, NAA, G, and BA) compared to untreated was determined using Rancimat method Table (4). From the obtained data, it could be observed that the oxidative stability of samples under study were 28.75, 31.50, 34.00, 36.60, 35.80 and 34.20 hrs untreated (C) and treated samples by CAC, K, NAA, G, and BA) respectively. The decrease and increase of olive oil stability in relation to the nature content of polyphenol and tocopherol compounds as shown Table (6) in total phenols content as well as we will discuss later. The relationship between oxidative stability and the concentration of polyphenols has also been well established by Aparicio and Luna, (2002). The redox properties of polyphenols allow them to act as hydrogen donors and singlet oxygen quenchers, hence their role as antioxidants which play roles in decreasing oxidation of oils According to Kanavouras and Coutelieris, (2006).

There is a strong relationship between sensory attributes and the content of phenolic compounds of the olive oil (Mateos *et al.,* 2007). As shown in Table (4) the sensory evaluation of all samples under study were determined. Treated trees by (NAA and BA) were recorded a higher significant than control and other treatments, while, the treated trees with (CAC) and untreated (C) were recorded a lower value in sensory evaluation. Generally, the differences between all investigated samples in organoleptic test perhaps due to these treatments that lead to increase the percentage of oil phenolic compounds and therefore affect the organoleptic properties Gutierrez *et al.,* (1992).

Fatty acids composition:

The fatty acids composition of virgin olive oil has great importance from a health point of view. Olive oil contains mainly

monounsaturated fat. The ratio of the different fatty acids in the oil influences the stability of the oil, as well as determining its nutritional value. Some fatty acids are considered to be better than others. The main fatty acid is oleic acid, which can represent between 55 and 83% of the total fat. Table (5) illustrated that the effect of some treatments by (CAC, K, NAA, G, and BA) compared with untreated (C) on fatty acid composition of virgin olive oil extracted from Picual cv. in seasons 11/12 and 12/13. The major unsaturated fatty acids in all samples under study were oleic acid followed by linoleic acid, while, the major saturated fatty acids in all samples under study were palmitic acid followed by stearic acid.

Table 5: Effect of treated olive (Picual cv.) by some materials on fatty acids composition.

Fatty acids		Treatments					
		(C)	(CAC)	(K)	(NAA)	(G)	(BA)
C16:0	11/12	16.25±2.11	15.59±1.90	15.80±2.01	14.96±1.81	15.33±1.71	15.36±1.75
	12/13	16.55±2.19	15.60±2.00	16.20±2.12	15.45±1.90	15.63±1.80	15.89±2.11
	Mean	16.40±2.20	15.59±1.90	16.50±2.22	15.20±1.86	15.48±1.75	15.62±1.91
C16:1	11/12	0.87±0.11	2.18±0.18	2.61±0.17	2.01±0.15	2.00±0.14	2.06±0.13
	12/13	0.85±0.10	2.23±0.20	2.50±0.22	2.31±0.19	2.40±0.20	2.36±0.20
	Mean	0.86±0.11	2.20±0.19	2.60±0.25	2.16±0.13	2.20±0.16	2.21±0.15
C17:0	11/12	0.03±0.001	0.04±0.001	0.03±0.001	0.04±0.001	0.06±0.001	0.03±0.001
	12/13	0.03±0.001	0.06±0.001	0.05±0.001	0.04±0.001	0.04±0.001	0.03±0.001
	Mean	0.03±0.001	0.05±0.001	0.04±0.001	0.04±0.001	0.05±0.001	0.03±0.001
C17:1	11/12	0.16±0.01	0.09±0.001	0.09±0.001	0.10±0.001	0.11±0.001	0.08±0.001
	12/13	0.12±0.01	0.11±0.01	0.09±0.001	0.10±0.001	0.13±0.001	0.12±0.001
	Mean	0.14±0.01	0.10±0.01	0.09±0.001	0.10±0.001	0.12±0.001	0.10±0.001
C18:0	11/12	2.13±0.15	2.68±0.21	2.85±0.20	2.52±0.19	1.95±0.10	2.16±0.14
	12/13	2.43±0.19	2.78±0.25	2.55±0.18	2.64±0.21	2.19±0.13	2.29±0.20
	Mean	2.28±0.17	2.73±0.22	2.70±0.20	2.58±0.20	2.07±0.01	2.22±0.22
C18:1	11/12	65.22±5.90	70.54±6.31	71.06±6.86	73.42±7.51	72.87±7.20	73.71±7.41
	12/13	64.99±5.42	70.10±6.22	71.12±6.90	73.00±7.33	72.35±7.00	73.10±7.12
	Mean	65.90±6.10	70.99±6.55	71.09±6.85	73.21±7.42	72.61±7.19	73.40±7.00
C18:2	11/12	6.52±0.59	6.02±0.49	5.59±0.45	4.710.37	4.57±0.35	4.56±0.36
	12/13	6.23±0.55	6.31±0.53	6.00±0.56	5.23±0.42	5.10±0.41	5.40±0.45
	Mean	6.37±0.57	6.18±0.60	5.39±0.43	4.97±0.39	4.83±0.38	5.02±0.40
C18:3	11/12	1.17±0.11	0.95±0.11	0.83±0.13	0.80±0.10	0.90±0.12	0.85±0.10
	12/13	1.10±0.09	0.92±0.10	0.87±0.15	0.83±0.10	0.92±0.12	0.83±0.10
	Mean	1.13±0.10	0.93±0.10	0.85±0.15	0.82±0.10	0.91±0.12	0.84±0.01
C20:0	11/12	0.21±0.02	0.56±0.09	0.46±0.09	0.52±0.09	0.46±0.06	0.44±0.03
	12/13	0.19±0.01	0.52±0.08	0.46±0.09	0.54±0.10	0.44±0.05	0.44±0.03
	Mean	0.20±0.02	0.54±0.08	0.46±0.09	0.53±0.09	0.45±0.05	0.44±0.03
C20:1	11/12	0.21±0.01	0.34±0.10	0.28±0.08	0.34±0.07	0.31±0.03	0.30±0.02
	12/13	0.19±0.01	0.36±0.10	0.26±0.07	0.34±0.07	0.29±0.03	0.32±0.01
	Mean	0.20±0.01	0.35±0.10	0.27±0.07	0.34±0.07	0.30±0.03	0.31±0.02
C22:0	11/12	0.12±0.001	0.12±0.001	0.10±0.001	0.13±0.001	0.10±0.001	0.09±0.001
	12/13	0.10±0.001	0.12±0.001	0.10±0.001	0.11±0.001	0.12±0.001	0.11±0.001
	Mean	0.11±0.001	0.12±0.001	0.10±0.001	0.12±0.001	0.11±0.001	0.10±0.00

The data (values ± SE) are the mean values of three measurements for the same sample.

On the other hand, the oleic acid of olive oil samples extracted from Picual olive fruits treated by (BA) recorded a higher significantly in all seasons compared to control and other treatments. The oleic acids ranged between 65.90% in untreated samples to 73.40% in (BA) samples at the means. In contrary, linoleic acid ranged between 4.83% in treated sample by (G) to 6.37% in untreated sample (C) at the means. Besides, palmitic acid ranged between 15.20% in treated sample by (NAA) to 16.40% in untreated sample (C) at the means. Whereas, the stearic acid ranged between 2.07% in treated samples by (G) to 2.73% in treated samples by (CAC) at the means.

Linoleic acid is play important role in adulteration of virgin olive oil in the samples under study, the linolenic acid into limits according to (IOC 2009).For the other fatty acids (C16:1, C17:0, C18.3, C20:0, C20:1 and C22:0 were found in small amount. The differences in fatty acids in all samples under this study may be due to the differences of treatments (CAC, K, NAA, G, and BA) compared to untreated samples (C) under study. These results are in agreement with (IOC (2009)

Minor components:

Phenolic compounds, is perhaps the most important of the minor components in olive oil, owing to their powerful antioxidant effect on the oil and the resulting contribution to shelf-life stability. Polyphenol is a general term used to describe natural substances that contain a benzene ring with one or more hydroxyl groups containing functional derivatives that include esters, methyl esters and glycosides According to Tsimidou, (1998). From tabulated data in Table (6) illustrated that the effect of some treatments on minor components of olive oil extracted from Picual olive fruits cv. in seasons 11/12and 12/13. The treated olive sample by (BA) recorded a higher significant in total polyphenol followed by treated sample by (NAA), but the untreated sample (control) recorded lower significant in total polyphenol ppm Table (6). The phenolic compounds in olive oil depend on several factors such as the crop, origin, variety, ripeness, conservation of the olives, climate, plantation process, technological processes used for oil extraction, olive oil transport, and the harvesting system (De Jong and Lanari, 2009; and Ben Othman *et al.,* 2009).

The tocopherol content of virgin olive oil is important to protect lipids against autoxidation and, therapy, to increase its storage life and value as a wholesome food. Total tocopherol ppm in treated sample oil by (BA) was recorded a significantly increased (281.50ppm) followed by treated sample oil by (NAA), while the untreated sample oil (C) was recorded a lower significant in total tocopherol (ppm). These variations in tocopherol content may be due to the differences in treated olive compared with control (without treated). This in agreement with results that reported by Frega *et al.,* (2005).

Bitter index at K225 test has been reported to have a strong relationship with total phenol content and the calculated value for intensity of bitterness provided as assay and strong tool for bitterness assessment without the use of more expensive sensory evaluation (Mateos *et al.,* 2007; Beltran *et al.,* 2007; Inarejos-Garcia *et al.,* 2009; and Skevin *et al.,* 2003).

The treated sample by (BA) gave a high content in bitter index flowed by treated sample by (G), while the lowest value was found in untreated sample (C) Table 6). Generally, not found clearly significant between all olive oil samples under study in bitter index value.

The total natural pigment content of oils is important quality parameters because they correlate with color, which is a basic attribute for evaluating olive oil quality. Pigments are also involved in autoxidation and photo-oxidation mechanisms (Minguez-Mosquera, *et al.,* 1990). Total chlorophyll and carotenoides in all olive oil samples at mean ranged from 11.25 to 14.65ppm and 11.10 to 12.55ppm respectively. The oil extracted from treated sample with (G) had higher contents of chlorophyll, while, the oil extracted from untreated sample (C) had higher content of carotenoides.

Table 6: Effect of treated olive (Picual cv.) by some materials on minor components of virgin olive oil.

Minor components		Treatment					
		(C)	(CAC)	(K)	(NAA)	(G)	(BA)
Total phenols (ppm)	11/12	260.00±16.20	270.00±17.10	270.00±17.10	290.00±19.33	280.00±18.20	300.00±20.50
	12/13	230.00±15.50	275.00±17.30	260.00±16.12	290.00±19.33	287.00±18.33	293.00±19.31
	Mean	245.00±15.99	272.50±17.20	265.00±16.80	290.00±19.33	283.50±18.19	296.50±19.22
α-tocopherol (ppm)	11/12	263.00±16.70	266.00±16.60	275.00±18.50	275.00±18.11	270.00±17.13	280.00±18.22
	12/13	230.00±15.80	254.00±15.90	258.00±16.00	265.00±16.70	257.00±15.90	283.00±18,81
	Mean	246.50±15.92	260.00±16.20	266.50±17.20	270.00±17.02	263.50±16.22	281.50±18.60
Bitter index (K225)	11/12	0.19±0.001	0.20±0.001	0.21±0.001	0.22±0.001	0.21±0.001	0.23±0.001
	12/13	0.17±0.001	0.22±0.001	0.19±0.001	0.22±0.001	0.24±0.001	0.25±0.001
	Mean	0.18±0.001	0.21±0.001	0.20±0.001	0.22±0.001	0.23±0.001	0.24±0.001
Chlorophyll (ppm)	11/12	13.60±1.20	11.50±0.85	11.00±0.81	11.70±0.90	15.00±1.51	12.00±1.00
	12/13	13.00±1.11	11.60±0.88	11.50±0.89	11.40±0.85	14.30±1.43	12.40±1.14
	Mean	13.30±1.19	11.55±0.87	11.25±0.85	11.55±0.88	14.65±1.45	12.20±1.02
Carotenes (ppm)	11/12	12.50±0.95	11.20±0.71	12.30±1.01	11.90±0.93	12.50±1.05	12.20±1.02
	12/13	12.60±0.99	11.00±0.69	12.30±0.01	12.00±1.00	12.40±1.04	12.30±1.13
	Mean	12.55±0.96	11.10±0.68	12.30±0.01	11.95±0.95	12.45±1.10	12.25±1.05

The data (values ± SE) are the mean values of three measurements for the same sample.

CONCLUSION

From the obtained results in this study, by comparing means of treatments it was concluded that there were significant effect of treatments for yield/tree, fruit weight, and oils percentage. However, Girdling, Boric acid, Naphthalene acetic acid and Kaolin showed better response than that control and calcium carbonate to all treatments. Also, Girdling, Boric acid, Naphthalene acetic acid and Kaolin were superior to other treatments for development of quality indices, fatty acids composition, oxidative stability and minor components.

ACHNOLEDGMENT

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تعظيم الاستفادة من اشجار الزيتون من خلال استخدام بعض المواد وتاثيراتها على خواص الجودة لزيت الزيتون صنف البيكوال

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[2] قسم بحوث الزيتون – معهد بوث البساتين- مركز البحوث الزراعية – جيزة – مصر.

الملخص العربى

يهدف هذه البحث الى دراسة تأثير بعض المعاملات (التحليق فالاسبوع الاول من شهر يناير والرش بالكولين عند مستوى٠,٥٠٪ فى منتصف ديسمبر) والمعاملات الكيماوية (الرش كربونات الكالسيوم عند مستوى ٥,٠٠٪فى منتصف ديسمبر والرش بحامض النفثالين الثلجى عند مستوى ١٠٠ جزء فى المليون فى منتصف ديسمبر، والرش بحامض البوريك عند مستوى ٣٠٠ جزء فى المليون فى الاسبيوع الاول م شهر مارس) على انتاجية الزيت وخواص الجودة والمكونات الصغرى والاحماض الدهنية لزيت الزيتون صنف البيكوال.

تم تقدير انتاجية/الشجرة، وزن الثمار، وزن النواة، وزن اللحم، اللحم/الثمرة، اللحم/النواة، النسبة المئوية للرطوبة والزيت. كما تم ايضا تقدير خصائص الجودة (رقم الحموضة، رقم البيروكسيد، الامتصاص فى منطقة الاشعة الفوق بنفسجية عند طول موجى ٢٣٢ و٢٧٠ نانوميتر والدلتا K). ايضا تم تقدير الخواص الحسية، والفينولات الكلية، والتوكوفيرولات، ودليل المرارة عند طول موطى ٢٢٥نانوميتر، ومحتوى الصبغات، والثبات الاكسيدى باستخدام جهاز الرانسيمات عند ١٠٠°م، والتعرف على الاحماض الدهنية باستخدام جهاز التحليل الكروماتوجرافى الغازى.

أشارت النتائج الى ان معاملة اشجار الزيتون صنف البيكوال باستخدام التحليق وحامض البوريك وحامض نفثالين الثلجى والكولين اعطت محتوى اعلى فى نسبة الزيت للشجرة. ايضا نفس المعاملات اعطت افضل القيم فى خصائص الجودة ومحتوى الفينولات الكلية والتوكوفيرولات والثبات الاكسيدى بالمقارنة بالعينة الغير معاملة (الكنترول) والمعاملة بكربونات الكالسيوم. على الجانب الاخر، اعطت العينات المعاملة بـ (وحامض البوريك وحامض نفثالين الثلجى والكولين) تفوقا ملحوظا فى مستويات حامض الاوليك.

واخيرا يمكن القول بانه نستطيع استخدام (وحامض البوريك وحامض نفثالين الثلجى والكولين) لزيادة انتاجية اشجار الزيتون صنف البيكوال وايضا تحسن من خصائص جودة الزيت المستخلص. كما ان هذه المعاملات تزيد من مستويات حامض الاوليك اكثر من العينة الغير معاملة (الكنترول).