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EFFECT OF SPRAYING KAOLIN AND CALCIUM CARBONATE ON THE PRODUCTIVITY OF"AGGEZI AND PICUAL" OLIVE CVS.

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ABSTRACT

This work was conducted to investigate the effect of foliar sprays of kaolin and Calcium Carbonate (5%) on vegetative growth, blooming, fruiting aspects and characteristices, fruit physical and chemical contents of "Aggizi Shamy" and "Picual" olive cvs. throughout two successive seasons (2011and 2012 seasons). Trees were 15-year-old and planted at 6X6 m. apart in a sandy soil in a private orchard at AL-Khatatba, Minufiya Governorate. The study aims at improving growth and productivity of olive trees. Data revealed that kaoline on mid Jan. increased significantly the number of leaves of Aggezi Shamy in both seasons, whereas kaolin added on mid Dec., Jan, and Feb. gave the same effect on Picual cv. . As for the leaf area of Aggezi cv. was influenced significantly by kaolin on mid Feb. in both growing seasons, while as the same treatment on mid Dec. increased leaf area significantly in picual cv.. Concerning the internode length kaolin on mid Dec. gave the highest significant values compared to the control and other treatments in both cultivars in both seasons. Calcium carbonate in mid dec. and kaolin in mid Feb increased significantly the sex ratio values of both Aggezi and Piculal cvs. in both seasons, respectively. Kaolin in mid Dec. increased significantly number of fruit set (%), number of fruit per meter and yield (Kg/tree) of Aggezi and Picual cvs. in both seasons. Kaolin in mid Dec. gave the highest significant values in fruit length and width of Aggezi and Picual cvs. during the two growing seasons. Although fruit weight (g) of Picual cv. was affected significantly by kaolin on mid Feb. in both seasons, Aggezi cv. Affected by kaolin on mid Jan. and Kaolin in mid Feb in 2011 and 2012 seasons, respectively. As for flesh/fruit weight percentage, kaolin on mid Feb. surpassed other treatments in both cultivars.Calcium carbonate on mid Feb. increased oil percentage on dry weight basis of Aggezi cv. in both seasons, whereas the same treatment affected significantly Picual cv. during the second season only.

Keywords: Olive, Kaolin, Calcium Carbonate, Vegetative Growth, Blooming, Fruit characteristics and oil content.

INTRODUCTION

Olive tree (*Olea europaea* L.) belongs to the family Oleaceae. It can thrive and produce at 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 at reclaimed lands that may achieve highly expensive either in local or in foreign markets. In addition, olive offers a great economic potential , also have a good nutritional and medical uses table fruits or for oil production. olive production plays an important role in the economy of many Mediterranean

countries. Hence, olive trees areas increased rapidly in Egypt and reached about 163273 Feddan , with total production about 611600 tons, where 20% of the total fruit production produces about 10000 tons of olive oil (according to the latest statistics of Ministry of Agriculture, 2010-2011). But, there are many areas affected with productivity reduction (according to the latest statistics of Ministry of Agriculture, 2006-2010) and It is the problem of planted olives areas in Egypt.This constrains causes severe losses for olive growers income expressed in disturbances in yearly income of the orchard and poor fruit quality. Environmental condition play an important role in growth and productivity of olive cultivars as productivity varies according to environmental and climatic conditions (lavee, 1989) and (AL-Khawaga, 2001).

Studies concerning environmental conditions influenced olive trees behavior, specially its bearing habit, yield and fruit quality are still in need for further studies. previous studies indicated that flower initiation in olive trees requirs winter chilling requirements as well as maximum flowering. On the other hand, high temperatures (over 30^{0}C) during blooming period induced reduction of fruit set in olive cvs.Hartman and whisle, 1975, pinney and polito, 1990 and Martin, 1991).

Consequently, using some natural materials (kaolin and Calcium Carbonate) are sprayed over tree canopies for studying impact of these treatments on alleviating direct solar radiation and reducing temperature in a trial to provide a part of chilling requirements of trees to improve production and quality.

MATERIALS AND METHODS

This work was conducted throughout two successive seasons of (2010-2011and 2011-2012) on 15-years-old "Aggizi Shamy" and "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.Trees were of normal growth, uniform in vigour and subjected to drip irrigation system. Twenty one bearing trees were randomly selected and divided into 7 treatments in three replicates (one tree for each) and arranged in complete randomized block design. This experiment was started in December and continued during 2011 and 2012 growing seasons. The texture of the used soil was sandy soil. Surface Soil samples (0-60 cm) were taken and air dried for carrying out physical and chemical analysis. The physical and chemical analysis of the soil are presented in Tables (1, 2 and 3).

Table (1): Physical analysis of the orchard experimental soil

Sample	Depth cm.	Particles size distribution			Texture
		Clay%	Silt%	Sand%	
Soil	0-60	6.60	1.14	92.26	Sandy soil

Table (2): Chemical properties of the orchard experimental soil

Sample	Depth	meq/L								$CaCo_3$ %	P	H	E	C
		Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	Cl^{-}	SO_4^{-}					
Soil	0-60	2	0.4	1.22	0.2	Nil	0.8	1.5	1.52	1.44	7.7		0.24	

Table (3): O.M%, O.C %, C/N, Micro and macro elements in the experimental soil.

Sam-ple	Depth	O.M %	O.C %	C/N	Micro (ppm.)					Macro (mg/l.)		
					Mn	Zn	Cu	Fe	B	K	P	N
Soil	0-60*	0.67	0.39	0.001	18.6	1.2	0.2	3.3	0.3	128	26	40

*** Mean values of 3 samples for this depth**

In addition, the usual farm managements in the region were followed. The selected trees were fertilized with 20 m3 analyzed organic manure/fed./year. The recommended water quantities for olive trees (1500-2000 cubic meter/fed) where used through drip irrigation system.The irrigation water samples were taken to determine their, EC (Electrical Conductivity), pH, soluble cations [Ca^{++} (calcium), Na^{+} (Sodium), Mg^{++} (Magnesium) and K^{+} (Potassium)] and soluble anions [CO3 (Carbonate), HCO3 (Bicarbonate), Cl (Chloride) and SO4 (Sulphate)] according to the methods described by (Jackson, 1967). Some heavy metals "Mn (Manganese) and Cu (Copper) in all water samples (filtrates) were spectrophotometrically determined, (Table 4).

Table (4): Chemical analysis irrigation water samples.

Soluble cations, anions (mill equivalent/Liter and BO (mg/L.)

EC	pH	SAR	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	CO_3^{-}	HCO_3^{-}	Cl^{-}	SO_4^{-}
1.95	7.30	5.93	6.00	1.00	11.10	0.40	Nil	3.80	1.50	13.20

S.S.P %	R.S.C	B (ppm)
60.00	3.20	1.35

The trees were treated with either of the following treatments:
Designing experiment of using some natural materials (kaolin and Calcium Carbonate) are sprayed over tree canopies for studying impact of these treatments on tree growth and fruit quality.

1-Control (untreated).
2- Kaolin (5%) on mid December.
3-Kaolin (5%) on mid January.
4-Kaolin (5%) on mid February.
5- Calcium Carbonate (5%) on mid December.
6-Calcium Carbonate -(5%) on mid January.
7- Calcium Carbonate (5%) on mid February

Staticstical Analysis:

The experiment was arranged in a randomized complete blocks design and the obtained data were subjected to analysis of variance and significant differences among means were determine according to Snedecor and Cochran.(1980).In addition. Significant differences among means were distinguished according to the Duncan multiple test range Duncan. (1955).

RESULTS AND DISCUSSION

This study investigate the effect of 5% kaolin and calcium carbonate spraying on Aggizi Shamy and Picual cvs. vegetative growth, blooming, fruiting aspects, characteristics and fruit chemical content during 2011 and 2012 seasons

4-1-1- Vegetativ growth

Data in Table (1) showed the effect of kaolin and calcium carbonate (5%) on mid Jan.on Aggizi Shamy and picual cvs. vegetative growth during 2011 and 2012 seeasons. It is obvious that, kaolin foliar application increased significantly the number of leaves of Aggezi cv. compared to the control and other treatments during 2011 and 2012 seasons. Whereas, the kaolin in mid Dec., mid Jan. and mid Feb.surpassed significantly other treatments and the control in Picual cv. in both seasons. Mean time calcium carbonate in mid. Feb. gave the same effect during 2012 season.

Table (1): Effect of kaolin and calcium carbonate spraying 5% on growth of Aggezi Shamy and Picual cvs. during 2011 and 2012 seasons.

Treatments	Aggezi Shamy					
	Number of leaves		Leaf area (cm^2)		Internodes Length (cm)	
	2011	2012	2011	2012	2011	2012
Control untreated.	143. B	143. B	3.70 E	3.85 F	1.40 D	1.40 D
Kaolin mid Dec.	118. E	111. E	4.58 C	5.12 C	1.70 A	1.80 A
Kaolin mid JaNo.	154. A	144. A	4.58 C	5.16 B	1.30 E	1.40 D
Kaolin mid Feb.	143. B	125. D	5.16 A	5.45 A	1.40 D	1.60 B
Calcium Carbonate in mid Dec.	133. C	125. D	4.31 D	4.58 E	1.50 C	1.60 B
Calcium Carbonate in mid JaNo.	125. D	133. C	4.58 C	4.90 D	1.60 B	1.50 C
Calcium Carbonate in mid Feb.	143. B	125. D	5.00 B	5.45 A	1.50 C	1.60 B
	Picual					
Control untreated.	125. D	118. C	3.55 F	3.86 F	1.30 D	1.50 B
Kaolin mid Dec.	154. A	133. A	5.16 A	5.48 A	1.60 A	1.70 A
Kaolin mid JaNo.	154. A	133. A	4.69 C	5.30 B	1.50 B	1.70 A
Kaolin mid Feb.	154. A	133. A	3.81 E	4.20 E	1.40 C	1.63 A
Calcium Carbonate in mid Dec.	143. B	125. B	4.84 B	4.89 C	1.40 C	1.60 AB
Calcium Carbonate in mid JaNo.	133. C	118. C	4.47 D	4.58 D	1.50 B	1.70 A
Calcium Carbonate in mid Feb.	143. B	133. A	3.81 E	3.86 F	1.40 C	1.50 B

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

Concerning the leaf area (cm^2) in table (1) the kaolin foliar application in mid Feb. gave the highest significant values in comparison with the control and other treatments in Aggizi Shamy cv. during 2011 and 2012seasons.whil as calcium carbonate in mid. Feb. showed the same effect during 2012 season. Whereas, the kaolin in mid Dec.surpassed significantly other

treatments and the control in Picual cv. in both seasons. These results were in agreement with those obtained by AL-Khawaga, (2001), Helally, (2008) and Saad El-Din-Ikram *et al*, (2010)

In regard to the Internodes length (cm) in table (1) kaolin in mid Dec. on Aggizi Shamy cv. Increased significantly the Internodes length (cm) compared to the control and other treatments during 2011 and 2012 seeasons. Whereas, the kaolin in mid Dec.surpassed other treatments and the control in Picual cv. in both seasons except kaolin in mid Jan.,in mid Feb., calcium carbonate in mid Dec. and in mid. Jan. showed the same effect during 2012 season.These results were in agreement with those obtained by AL- Khawaga, (2001), Galán *et al.*, (2005); Garcia-Mozo *et al.*, (2006), Geßler *et al.*, (2007), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al* ,(2010).

4-1-2- Blooming characteristics.

The blooming characteristics presented in table (2, 3 and 4).Concerning the No.of inflorescences in table (2), data reveald that, the kaolin in mid Dec. increased significantly the No.of inflorescences compared to the control and other treatments on Aggizi Shamy and Picual cvs.during 2011 and 2012 seeasons. Whereas, kaolin in mid.Jan. gave the same effect during 2012 season on Aggizi Shamy only. These results are supported by Nouman *et al.*, (2000); El-khawaga (2001); El-sayed *et al.*, (2006) and Saad El-Din-Ikram *et al*, (2009)

Table (2): Effect of kaolin and calcium carbonate spraying 5% on flowering of Aggezi Shamy and Picual cvs. during 2011 and 2012 seasons.

Treatments	(Aggezi Shamy)					
	No. of inflorescence/shoot		Inflorescence length(cm)		No. of total flowers / inflorescence	
	2011	2012	2011	2012	2011	2012
Control untreated.	7.00 B	11.00 C	1.80 E	2.00 D	10.80 G	13.30 C
Kaolin mid Dec.	10.00 A	14.00 A	1.84 E	2.00 D	11.56 E	14.00 B
Kaolin mid JaNo.	10.00 A	13.00B	2.13 D	2.50 BC	13.00 B	15.60 A
Kaolin mid Feb.	7.00 B	12.00BC	2.80 A	3.20 A	14.00 A	14.00 B
Calcium Carbonate in mid Dec.	8.00 B	12.00BC	2.33 C	2.40 C	11.44 F	13.90 B
Calcium Carbonate in mid JaNo.	7.00 B	11.00 C	2.48 B	2.50 BC	12.70 D	15.00 A
Calcium Carbonate in mid Feb.	7.00 B	12.00BC	2.50 B	2.60 B	13.00 C	14.00 B
	(Picual)					
Control untreated.	5.33 D	10.00 C	1.99 D	2.40 C	8.00 E	12.00 D
Kaolin mid Dec.	11.00 A	14.00 A	2.62 A	3.00 A	11.30 A	16.00 A
Kaolin mid JaNo.	8.50 B	11.50 B	1.85 E	2.40 C	8.10 DE	13.00CD
Kaolin mid Feb.	7.50 BC	10.50 C	1.99 D	2.40 C	9.90 BC	14.00BC
Calcium Carbonate in mid Dec.	7.50 BC	10.58 C	2.15 C	2.00 D	10.00 B	14.00 B
Calcium Carbonate in mid JaNo.	7.00 C	10.00 C	2.50 B	3.00 A	11.00AB	14.00 B
Calcium Carbonate in mid Feb.	7.00 C	10.20 C	2.50 B	2.50 B	9 .00 CD	13.00 C

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level

As for inflorescence length, the kaolin foliar application in mid Feb. gave the highest significant values in comparison with the control and other treatments in Aggizi Shamy cv. during 2011 and 2012seasons. Whereas, the kaolin in mid Dec.surpassed other treatments and the control significantly in Picual cv. in both seasons in addition to calcium carbonate in mid. Jan. showed the same effect during 2012 season.Similar results were proved by El-sayed *et al.*, (2006) and Saad El-Din-Ikram *et al*, (2009)

Inregared to the No. of total flowers per inflorescence in table (2), Kaolin in mid Feb. and calcium carbonate in mid. Jan.in addition to kaolin in mid Jan. gave the highest significant values in no. of total flowers per inflorescence during 2011 and 2012 seasons respectively. As regard to picual cv. The kaolin in mid Dec. showed the highest significant values in both seasons. whereas, calcium carbonate in mid. Jan. showed the same effect during 2011 season only. These results were in agreement with those obtained by AL-Khawaga, (2001), Galán *et al.*, (2005); Garcia-Mozo *et al.*, (2006), Geßler *et al.*, (2007), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009) and(2010).

As for, No.of perfect flowers per inflorescence (Table, 3), the calcium carbonate in mid Dec. surpassed other treatments and the control significantly in Aggizi cv. In both seasons also Kaolin in mid Feb. showed the same effect during 2011 season.As regard to picual cv. the kaolin in mid Feb. showed the highest significant values in both seasons meantime kaolin in mid Dec. showed the same effect during 2011 season. These results were consistent with those obtained by AL- Khawaga, (2001), Galán *et al.*, (2005); Garcia-Mozo *et al.*, (2006), Geßler *et al.*, (2007), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Table (3): Effect of kaolin and calcium carbonate spraying 5% on flowering of Aggezi Shamy and Picual cvs. during 2011 and 2012 seasons.

Treatments	(Aggezi Shamy)					
	No. of perfect flowers		Sex expression (%)		Flowering density (%)	
	2011	2012	2011	2012	2011	2012
Control untreated.	4.00 D	6.00 D	37.04 G	45.11 E	41.18 C	55.00 D
Kaolin mid Dec.	5.70 C	8.45 B	49.31 D	59.93 B	47.62 A	70. 00 A
Kaolin mid JaNo.	6.00 C	7.50 C	46.15 E	48.08 D	47.62 A	52. 00 E
Kaolin mid Feb.	7.20 AB	8.60 B	51.43 C	61.43 B	48.00 A	48. 00 F
Calcium Carbonate in mid Dec.	7.90 A	9.76 A	69.06 A	70.22 A	45.71 B	60. 00 B
Calcium Carbonate in mid JaNo.	5.60 C	7.27 C	44.09 F	48.47 D	41.18 C	57. 89 C
Calcium Carbonate in mid Feb.	7.00 B	8.00 BC	53.85 B	57.14 C	41.18 C	48.00 F
	(Picual)					
Control untreated.	4.30 C	5.01 G	53.75 F	41.75 G	31.35 F	40.00 F
Kaolin mid Dec.	5.50 AB	8.96 B	48.67 C	56.00 C	57.89 A	70.00 A
Kaolin mid JaNo.	3.40 D	6.00 F	41.98 E	46.15 F	50.00 B	63.89 B
Kaolin mid Feb.	6.14 A	9.38 A	62.02 A	67.00 A	44.12 D	52.50 D
Calcium Carbonate in mid Dec.	4.90 BC	7.83 E	49.00 D	55.93 E	44.12 D	58.78 C
Calcium Carbonate in mid JaNo.	5.20 B	8.00 D	47.27 CD	57.14 D	46.67 C	50.55 E
Calcium Carbonate in mid Feb.	5.00 BC	8.50 C	55.56 B	65.38 B	41.18 E	51.51 E

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level

Table (3) presents, sex expression (%) and the calcium carbonate in mid Dec. gave the highest significant values compared to other treatments and the control in Aggizi cv. in both seasons. Whereas, the kaolin in mid Feb.surpassed other treatments and the control in Picual cv. in both seasons. These results were approved with those obtained by AL- Khawaga, (2001), Galán *et al.*, (2005); Garcia-Mozo *et al.*, (2006), Geßler *et al.*, (2007), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Data reveald that, the kaolin in mid Dec. treatment Increased significantly the Flowering density (%)of Aggizi Shamy cv. compared to the control and other treatments during 2011 and 2012 seeasons. And kaolin in mid. Jan.and mid Feb. showed the same analogous effect during 2011 season. As regard to picual cv.the kaolin treatment in mid Dec.showed the highest significant values in both seasons.These results were in agreement with those obtained by AL- Khawaga, (2001), Galán *et al.*, (2005); Garcia-Mozo *et al.*, (2006), Geßler *et al.*, (2007), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Concerning the Beginning of bloom, full bloom and blooming duration are presented in table (4).

Table (4): Effect of kaolin and calcium carbonate spraying 5% on flowering of Aggezi Shamy And Picual cvs. during 2011 and seasons.

Treatments	(Aggezi Shamy)					
	Beginning bloom		Full bloom		Blooming period	
	2011	2012	2011	2012	2011	2012
Control untreated.	5/4	7/4	15/4	17/4	12	15
Kaolin mid Dec.	5/4	7/4	15/4	17/4	12	15
Kaolin mid JaNo.	5/4	7/4	15/4	17/4	12	15
Kaolin mid Feb.	5/4	7/4	15/4	17/4	12	15
Calcium Carbonate in mid Dec.	5/4	7/4	15/4	17/4	12	15
Calcium Carbonate in mid JaNo.	5/4	7/4	15/4	17/4	12	15
Calcium Carbonate in mid Feb.	5/4	7/4	15/4	17/4	12	15
	(Picual)					
Control untreated.	10/4	13/4	16/4	18/4	11	13
Kaolin mid Dec.	10/4	13/4	16/4	18/4	11	13
Kaolin mid JaNo.	10/4	13/4	16/4	18/4	11	13
Kaolin mid Feb.	10/4	13/4	16/4	18/4	11	13
Calcium Carbonate in mid Dec.	10/4	13/4	16/4	18/4	11	13
Calcium Carbonate in mid JaNo.	10/4	13/4	16/4	18/4	11	13
Calcium Carbonate in mid Feb.	10/4	13/4	16/4	18/4	11	13

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

It is appeared that, all the investigated trees bloomed at nearly the same date with no differences between treatments. The blooming duration lasted about 12 days during April (April,5- 17th) in the 2011 season and 15 days during (April, 7-22nd) in 2012season in Aggizi Shamy cv.As a general trend, blooming started by about 5days earlier in the first season than in the second one. As regard to picual cv. the blooming duration lasted about 11

days from April, 10 to April, 21st in the 2011 season and 13 days from April, 13 to April, 26th in 2012season, respectively.Full blooming date, however, was at April 15 and 17 in the first and second seasons, respectively Aggizi Shamy cv. Picual cv. full blooming date, was at April 16 and 18 in the first and second seasons, respectively. These results were in agreement with those obtained by De la Rosa, R.; Rallo, L.; and Rapaport, H.F. (2000), AL-Khawaga, (2001), Galán *et al.*, (2005); Garcia-Mozo *et al.*, (2006), Geßler *et al.*, (2007), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

4-1-3- Fruiting aspect.

Regarding fruit set %, No .of fruits per shoot and yield (kg)/tree of the studied treatments (kaolin and Calcium Carbonate) are presented in Table (5). Data performed that, the kaolin in mid Dec. increased significantly the fruit set % compared to the control and other treatments of Aggizi Shamy cv.during 2011 and 2012 seeasons. As regard to picual cv.The kaolin in mid Feb.and the kaolin in mid Dec. gave the highest significant values in fruit set % during 2011 and 2012 seasons, respectively. These results were go in line with those obtained by AL- Khawaga, 2001, Lavee, S. (2007), García-Mozo *et al.*, (2009),

Table (5): Effect of kaolin and calcium carbonate spraying 5% on No. of fruit / m, yield (kg)/tree and Fruit set (%) of Aggezi Shamy and Picual cvs. during 2011 and 2012 seasons.

Treatments	(Aggezi Shamy)					
	Fruit set (%)		No. of fruit / m		Yield (kg)/tree	
	2011	2012	2011	2012	2011	2012
Control.	31.00 F	35.0G	30.00 E	35.00 D	30.00 G	35.00 G
Kaolin mid Dec.	68.42 A	82.84 A	45.00 A	50.00 A	41.00 A	48.00 A
Kaolin mid JaNo.	66.60 B	81.50 B	35.00 C	40.00 C	36.00 C	43.00 C
Kaolin mid Feb.	54.00 D	58.14 E	40.00 B	42.00 B	39.00 B	43.00 B
Calcium Carbonate in mid Dec.	59.40 C	66.60 C	34 00 D	35.00 D	35.00 D	41.00 D
Calcium Carbonate in mid JaNo.	59.00 C	61.00 D	32.00 E	32.00 F	33.00 E	39.00 E
Calcium Carbonate in mid Feb.	49.00 E	55.01 F	32.00 E	30.00 G	31.00 F	38.00 F
	(Picual)					
Control.	30.00 G	50.00 F	30.00 E	21.00 F	35.00 G	25.00 G
Kaolin mid Dec.	69.60 B	70.00 A	47.00 A	40.00 A	55.00 A	40.00 A
Kaolin mid JaNo.	65.00 C	64.00 B	33.00 D	25.00 D	48.00 C	31.00 E
Kaolin mid Feb.	79.80 A	52.60 D	41.00 B	31.00 B	46.00 D	37.00 B
Calcium Carbonate in mid Dec.	63.41 D	58.78 C	33.00 D	27.00 C	50.00 B	35.00 C
Calcium Carbonate in mid JaNo.	48.75 F	50.00 F	28.00 F	23.00 E	42.00 F	30.00 F
Calcium Carbonate in mid Feb.	59.77 E	51.00 E	35.00 C	25.00 D	43.00 E	32.00 D

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

Kaolin treatment in mid Dec. increased significantly the No.of fruits/m of Aggizi Shamy and Picual cvs (Table, 5) compared to the control and other

treatments during 2011 and 2012 seeasons.these results were coincide with those obtained by AL- Khawaga, (2001), Lavee, S. (2007), García-Mozo *et al.*, (2009),

Data showed.the kaolin in mid Dec.on Aggizi Shamy and Picual cvs. increased significantly the yield (kg)/tree compared to the control and other treatments during 2011 and 2012 seeasons.these results were in agreement with those obtained by AL- Khawaga, (2001), El-Sayed *et al.*, (2006), Lavee, S. (2007),García-Mozo *et al.*, (2009),

4-1-3- fruit characteristics.

The fruit characteristics presented in table(6,7 and 8). It is obvious that the kaolin and calcium carbonate spraying 5% on fruit characteristics of Aggizi Shamy and Picual cvs.influenced significantly the majority of fruit characteristics in comparison with the contol during the two growing seasons.

Table (6): Effect of kaolin and calcium carbonate spraying 5% on fruit characteristics of Aggezi Shamy and Picual cvs.during 2011 and 2012 seasons.

Treatments	(Aggezi Shamy)					
	Longitudinal fruit diameter(cm.)		Equatorial fruit diameter (cm.)		Fruit weight (gm)	
	2011	2012	2011	2012	2011	2012
Control untreated.	3.00 D	2.70 C	2.50 C	2.30 E	10.87 E	8.58 G
Kaolin mid Dec.	3.30 A	3.00 AB	2.70 A	2.70 A	11.12 C	11.20 C
Kaolin mid JaNo.	3.20 B	3.10 A	2.70 A	2.50 C	11.90 A	11.40 B
Kaolin mid Feb.	3.10 C	3.20 A	2.60 B	2.60 B	11.30 B	11.60 A
Calcium Carbonate in midDec.	3.20 B	2.80 BC	2.50 C	2.40 D	10.11 F	10.63 F
Calcium Carbonate in mid JaNo.	3.10 C	2.60 C	2.60 B	2.30 E	10.50 D	10.70 D
Calcium Carbonate in mid Feb.	3.30 A	3.00 AB	2.70 A	2.50 C	11.10 C	10.70 E
	(Picual)					
Control untreated.	2.60 B	2.70 C	2.00 C	2.10 C	5.12 E	6.19 F
Kaolin mid Dec.	3.00 A	3.00 AB	2.20 A	2.30 A	6.30 B	8.38 C
Kaolin mid JaNo.	2.80 AB	2.90 B	2.20 A	2.20 B	6.15 C	8.30 D
Kaolin mid Feb.	2.80 AB	3.00 AB	2.20 A	2.20 B	6.67 A	9.30 A
Calcium Carbonate in mid Dec.	2.80 AB	3.00 AB	2.10 B	2.10 C	6.05 D	8.01 E
Calcium Carbonate in mid JaNo.	2.90 A	3.70 A	2.20 A	2.20 B	6.30 B	8.70 B
Calcium Carbonate in mid Feb.	2.70 B	3.00 AB	2.20 A	2.10 C	6.15 C	8.10 E

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

The fruit characteristics (longitudinal fruit diameter (cm), equatorial fruit diameter(cm)and fruit weight(g))in table (6). The kaolin in mid Dec.and Calcium Carbonate in mid Feb. increased significantly the longitudinal fruit diameter (cm) of Aggizi Shamy compared to the control and other treatments during 2011 and 2012 seeasons. Meanwhile kaolin in mid. Jan.and mid Feb. showed the same effect during 2012 season. Whereas, the kaolin in mid Dec., in mid Feb., Calcium Carbonate in mid Dec.and Calcium Carbonate mid

Jan. Surpassed other treatments and the control in Picual cv. in both seasons also kaolin in mid. Jan. during 2011season and Calcium Carbonate in mid Feb. during 2012 season showed the same effect. These results were in agreement with those obtained by AL- Khawaga, (2001), El-Sayed *et al.*, (2006), Lavee, S. (2007), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2010).

As for equatorial fruit diameter (cm), the kaolin foliar application in mid Dec. gave the highest significant values in comparison with the control and other treatments in Aggizi Shamy cv. during 2011 and 2012seasons. Meanwhile, kaolin in mid Jan.and Calcium Carbonate mid Feb. showed the same effect during 2011 season only. Whereas, the kaolin in mid Dec.Surpassed other treatments and the control significantly in Picual cv. in both seasons in addition the kaolin in mid. Jan., kaolin in mid Feb, calcium carbonate in mid. Jan. and calcium carbonate in mid Feb. showed the same effect during 2011 season. These results were coincide with those obtained by AL- Khawaga, (2001), El-Sayed *et al.*, (2006),Lavee, S. (2007),García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2010).

The Kaolin folir application in mid Jan. in the first season and kaolin in mid Feb.in the second season on Aggizi Shamy cv. gave the highest significant values in fruit weight (gm). As regard to, picual cv. The kaolin in mid Feb. showed the highest significant values during both seasons. These results were showed with those obtained by Parchomchuk, P. and Meheriuk, M. (1996),AL- Khawaga, (2001), El-Sayed *et al.*, (2006), García-Mozo *et al.*, (2009), Mahmoud A,*et al.*,(2010) ,Saad El-Din-Ikram *et al.*, (2010).

The stone characteristics (longitudinal stone diameter (cm), equatorial stone diameter (cm) and stone weight (g)) in table (7).

As related to the seed characteristics, the calcium carbonate in mid Jan. treatment on Aggizi Shamy cv. in the first season (2011) showed the highest seed length compared to the control and other treatments, In the second season, the calcium carbonate mid Feb. in addition to kaolin in mid Dec. gave the highest significant values in longitudinal stone diameter (cm) during (2012) season. As regard to picual cv. The calcium carbonate in mid Jan. showed the highest significant values in the first season (2011). , In the second season, the calcium carbonate mid Dec. in addition to calcium carbonate mid Feb. gave the highest significant values in longitudinal stone diameter (cm) during (2012) season. These results were approved by AL-Khawaga,(2001), El-Sayed *et al.*, (2006), García-Mozo *et al.*,(2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Table (7): Effect of kaolin and calcium carbonate spraying 5% on seed characteristics of Aggezi Shamy and Picual cvs. during 2011 and 2012seasons.

Treatments	(Aggezi Shamy)					
	Longitudinal stone diameter (cm.)		Equatorial stone diameter (cm.)		Seed weight (gm)	
	2011	2012	2011	2012	2011	2012
Control untreated.	1.80 B	1.70 C	1.10 AB	1.10 B	1.13 C	1.10 B
Kaolin mid Dec.	1.60 D	1.90 A	1.00 B	1.00 B	1.06 D	1.00 B
Kaolin mid JaNo.	1.70 C	1.80 B	1.10 AB	1.30 A	1.20 B	1.30 A
Kaolin mid Feb.	1.80 B	1.80 B	1.20 A	1.00 B	0.98 E	1.00 B
Calcium Carbonate in mid Dec.	1.70 C	1.80 B	1.00 B	1.00 B	0.94 E	1.00 B
Calcium Carbonate in mid JaNo.	1.90 A	1.70 C	1.00 B	1.00 B	1.30 A	1.00 B
Calcium Carbonate in mid Feb.	1.60 D	1.90 A	1.00 B	1.00 B	1.06 D	1.00 B
	(Picual)					
Control untreated.	1.80 B	1.60 E	1.10 A	0.90 B	1.10 A	0.82 F
Kaolin mid Dec.	1.80 B	1.80 B	0.92 C	0.90 B	0.97 C	0.94 B
Kaolin mid JaNo.	1.80 B	1.70 D	0.90 C	0.80 C	1.04 B	0.89 D
Kaolin mid Feb.	1.70 C	1.60 E	1.00 B	0.80 C	0.82 F	0.90 C
Calcium Carbonate in mid Dec.	1.80 B	1.90 A	1.00 B	1.00 A	0.90 E	1.09 A
Calcium Carbonate in mid JaNo.	1.90 A	1.70 C	1.10 A	0.90 B	0.90 D	0.90 E
Calcium Carbonate in mid Feb	1.80 B	1.90 A	0.90 C	1.00 A	1.04 B	1.10 A

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

As for equatorial stone diameter (cm), the kaolin foliar application in mid Feb.and mid Jan. gave the highest significant values in comparison with the control and other treatments in Aggizi Shamy cv. during 2011 and 2012 seasons.Whereas, the calcium carbonate in mid Jan.in addition to the control Surpassed other treatments in Picual cv. in the first season (2011), calcium carbonate in mid. Dec. and calcium carbonate in mid Feb. showed the same effect during 2012 season. These results were in agreement with those obtained by AL- Khawaga, (2001), El-Sayed *et al.*, (2006), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009) and (2010).

The calcium carbonate in mid Jan. in the first season and kaolin in mid Jan.in the second season. gave the highest significant values in seed weight (gm) of Aggizi Shamy cv). As regard to, picual cv.The control showed the highest significant values in the first season. In the second one, the calcium carbonate in mid Dec. in addition to calcium carbonate mid Feb. gave the highest significant values in seed weight (gm) during (2012) season. These results were in agreement with those obtained by AL- Khawaga, (2001), El-Sayed *et al.*, (2006),García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Data reveald that, the kaolin in mid Feb. on Aggizi Shamy cv. increased significantly the flesh weight (gm) compared to the control and other treatments during 2011 and 2012 seeasons. Whereas, the kaolin treatmnts

and the calcium carbonate treatmnts surpassed the control in Picual cv. in the first season, in the second season (2012), the kaolin in mid Feb. gave the highest significant values in flesh weight (gm).compared to the control and other treatments. These results were coincide with those obtained by Parchomchuk, P. and Meheriuk, M. (1996), AL- Khawaga, (2001), El-Sayed *et al.*, (2006),García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Table (8): Effect of kaolin and calcium carbonate spraying 5% on fruit characteristics of Aggezi Shamy and Picual cvs. during 2011and 2012 seasons.

Treatments	(Aggezi Shamy)					
	Flesh weight (gm)		Flesh/fruit weight (%)		Flesh/ston	
	2011	2012	2011	2012	2011	2012
Control untreated.	7.50 D	7.70 G	0.69 E	0.87 E	6.64 E	7.00 D
Kaolin mid Dec.	10.10 B	10.20 C	0.90 C	0.90 A	9.53 C	10.20 A
Kaolin mid JaNo.	10.10 B	10.23 B	0.91 B	0.90 A	8.42 D	7.87 C
Kaolin mid Feb.	10.90 A	10.50 A	0.96 A	0.90 A	11.12 A	10.50 A
Calcium Carbonate in mid Dec.	9. 17 C	9.59 E	0.91 B	0.89 B	10.19 B	9.59 B
Calcium Carbonate in mid JaNo.	9. 20 C	9.62 D	0.89 D	0.89 B	10.22 B	10.69 A
Calcium Carbonate in mid Feb.	10.10 B	9.53 F	0.90 C	0.89 B	9. 53 C	9.53 B
	(Picual)					
Control untreated.	4.00 B	5.40 F	0.78 F	0.87 A	3.64 F	6.59 E
Kaolin mid Dec.	5.28 A	7.44 C	0.84 D	0.89 A	5.44 D	7.91 D
Kaolin mid JaNo.	5.11 A	7.40 D	0.83 E	0.89 A	4.91 E	8.31 C
Kaolin mid Feb.	5.85 A	8.39 A	0.88 A	0.90 A	7.13 A	9.32 A
Calcium Carbonate in mid Dec.	5.20 A	6.92 E	0.86 B	0.86 A	5.78 B	6.35 F
Calcium Carbonate in mid JaNo.	5.34 A	7.80 B	0.85 C	0.90 A	5.93 C	8.67 B
Calcium Carbonate in mid Feb.	5.10 A	6.92 E	0.83 E	0.86 A	4.90 E	6.29 F

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

As for flesh/fruit weight percentage, the kaolin foliar application in mid Feb. gave the highest significant values in comparison with the control and other treatments in Aggizi Shamy cv. during 2011 and 2012seasons.Except the Kaolin in mid Dec.in addition to in mid Jan. showed the same effect during (2012) season.

Whereas, the kaolin in mid Feb. surpassed other treatments and the control in Picual cv. in the first season.and there is not any different significant between the control and other treatments, All treatments increased the flesh/fruit weight percentage in bath seasons in comparison with the control.

These results were in agreement with those obtained by Parchomchuk, P. and Meheriuk, M. (1996), AL- Khawaga, (2001), El-Sayed

et al., (2006), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Kaolin in mid Feb. gave the highest significant values in fleh/ston in Aggizi Shamy cv. during 2011 and 2012 seasons, respectively. Meanwhile, the kaolin in mid Dec.,and calcium carbonate mid Jan. showed the same effect during 2012 season.

As regard to picual cv. The kaolin in mid Feb. showed the highest significant values in both seasons. These results were in agreement with those obtained by Parchomchuk, P. and Meheriuk, M. (1996), AL- Khawaga, (2001), El-Sayed *et al.*, (2006),García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

4-1-5-- Fruit chemical content.

Data reveald that, the calcium carbonate mid Dec. increased significantly the fruit moisture (%) of Aggizi Shamy cv. compared to the control and other treatments during 2011 and 2012 seeasons. Whereas, the calcium carbonate in mid Dec. and the kaolin mid Dec.surpassed the control and other treatments in Picual cv. in the first season, and the second season respectvly.

These results were consistent with those obtained by Parchomchuk, P. and Meheriuk, M. (1996), AL- Khawaga, (2001), El-Sayed *et al.*, (2006), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009)and(2010).

Table (9): Effect of kaolin and calcium carbonate spraying 5% on fruit characteristics of Aggezi Shamy and Picual cvs. during 2011and 2012 seasons.

Treatments	(Aggezi Shamy)			
	Fruit moisture (%)		Fruit oil (%)	
	2011	2012	2011	2012
Control untreated.	75.70 C	75.60 B	11.70 E	11.72 F
Kaolin mid Dec.	73.20 F	73.20 D	11.80 E	11.80 E
Kaolin mid JaNo.	73.00 G	73.01 E	13.40 D	13.42 D
Kaolin mid Feb.	73.57 E	73.60 C	8.090 F	8.09 G
Calcium Carbonate in mid Dec.	77.80 A	77.80 A	16.40 C	16.40 C
Calcium Carbonate in mid JaNo.	75.80 B	72.90 F	34.10 B	34.00 B
Calcium Carbonate in mid Feb.	75.10 D	72.90 G	35.07 A	34.10 A
	(Picual)			
Control untreated.	62.50 F	68.80 G	45.10 A	40.60 E
Kaolin mid Dec.	69.56 B	70.40 A	34.00 F	37.20 G
Kaolin mid JaNo.	69.00 C	70.30 B	37.70 D	39.90 F
Kaolin mid Feb.	66.60 E	69.12 F	38.10C	43.23 C
Calcium Carbonate in mid Dec.	71.60 A	70.13 C	35.70 E	42.60 D
Calcium Carbonate in mid JaNo.	68.60 D	69.60 D	40.80 B	50.50 B
Calcium Carbonate in mid Feb.	69.60 B	69.50 E	40.80 B	50.50 A

Means within a column having the same letters are not significantly different according to Duncan's Multiple Range Test (DMRT) at 5% level.

As for fruit oil (%), the calcium carbonate in mid Feb. surpassed the control and other treatments in Aggizi cv. in both seasons. As regard to picual cv. the control and the calcium carbonate in mid Feb. showed the highest significant values during 2011 and 2012 seeasons respectvly.
These results were in agreement with those obtained by AL- Khawaga, (2001), El-Sayed *et al.*, (2006), García-Mozo *et al.*, (2009), Saad El-Din-Ikram *et al.*, (2009) and (2010).

Conclussion

This research can recommend the application of kaolin in mid Dec. for improving fruit set and in mid Jan. and Feb. to enhance fruit weight and yield Whereas calcium carbonate can be applied in mid Feb. to improve oil percentage as dry weight.

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تأثيرالرش بالكاولين وكربونات الكالسبوم علي تحسين إنتاجية أشجار الزيتون

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هذا البحث تم تنفيذه فى مزرعة خاصة فى منطقة الخطاطبة فى مزرعة خاصة قرب الطريق الصحراوى (مصر إسكندرية) على صنفى العجيزى الشامى والبيكوال عمر ١٥ سنة على مسافات زراعة 6 X٦ م فى أرض رملية لدراسة تأثير رش الكاولين وكربونات الكالسيوم بتركيز ٥% على النمو الخضرى والزهرى والثمرى والمحصول ونسبة الزيت وذلك فى موسمى النمو ٢٠١١ و٢٠١٢. وتهدف هذه الدراسة إلى تحسين النمو والإثمار فى أشجار الزيتون.

واسفرت النتائج كالأتى:

- أدى رش الكاولين فى نصف يناير إلى تحسين عدد الأوراق فى المتر الطولى لصنف العجيزى الشامى فى كلا موسمى النمو ، فى حين إضافة الكاولين فى نصف ديسمبر ونصف يناير ونصف فبراير أعطى نفس التأثير على صنف البيكوال. أما بالنسب للمساحة الورقية فإن صنف العجيزى قد تأثر معنوياً بالرش بالكاولين فى نصف فبراير فى كلا موسمى النمو ، فى حين الرش فى نصف ديسمبر بالكاولين أدى إلى زيادة معنوية فى المساحة الورقية لصنف البيكوال.
- وفيما يتعلق بطول السلامية فإن الكاولين فى نصف ديسمبر أعطى أعلى قيمة معنوية مقارنة بالكنترول فى كلا صنفى النمو وأثناء موسمى النمو.و فيما يتعلق بالنسبة الجنسية فكان الرش بكربونات الكالسيوم فى وسط ديسمبر والكاولين فى نصف فبراير أدى إلى زيادة معنوية فى كلا الصنفين وأثناء موسمى النمو . بينما الكاولين فى منتصف ديسمبر أعطى زيادة معنوية فى نسبة العقد وعدد الثمار فى المتر الطولى والمحصول لصنفى العجيزى والبيكوال وخلال موسمى النمو.على الرغم من زيادة وزن الثمار نتيجة الرش بالكاولين فى منتصف فبرار لصنف البيكوال فى كلا موسمى النمو ، إلا أن صنف العجيزى تأثر معنوياً بالرش بالكاولين فى منتصف يناير ومنتصف فبراير فى سنة ٢٠١١ وسنة ٢٠١٢ على الترتيب. وكذا بالنسبة لمعدل نسبة اللحم إلى وزن الثمرة فإن الرش بالكاولين فى وسط فبراير أدى إلى زيادة معنوية فى هذه النسبة لكلا صنفى الزيتون تحت الدراسة وفى موسمى النمو. ولقد أدى الرش بكربونات الكالسيوم فى منتصف فبراير أدى إلى زيادة نسبة الزيت منسوباً إلى أساس الوزن الجاف لصنف العجيزى خلال موسمى النمو ، أما البيكوال كان التأثير فى الموسم الثانى ٢٠١٢.

وتوصى هذه الدراسة بالرش بالكاولين فى الفترة من ديسمبر حت مارس كل شهر بالكولين ٥% لتحسين النمو والتزهير ونسبة العقد وصفات الجودة لثمار الزيتون والمحصول ، بينما كربونات الكالسيوم أدت إلى زيادة نسبة الزيت منسوباً إلى الوزن الجاف فى منتصف فبراير.

قام بتحكيم البحث

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