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EVALUATION OF SOME OLIVE CULTIVARS GROWN UNDER EGYPTIAN CONDITIONS

Samra, N.R.*; S.Z. El-Agamy and B.N. Samra***

*** Pomology Dept., Fac. of Agric., Mansoura Univ.**

**** Hort. Dept., Fac. of Agric., Assiut Univ.**

ABSTRACT

This study was carried out during the two successive seasons of 2005 and 2006 on three olive cultivars (Toffahi, Kroniaki and Picual) grown under newly reclaimed soil in Egypt to evaluate fruit production as well as the physical and chemical properties of the olives.

The obtained data revealed that Kroniaki produced a higher yield per tree (44.2 Kg) while Toffahi and Picual gave 37.8 and 36.2 Kg as a mean of two seasons, respectively. The data also reveal that pollen viability and fruit set percentage of Kroniaki were higher than those obtained from Toffahi or Picual. Whereas, average fruit weight and size of Toffahi was higher than Picual and Kroniaki.

Furthermore, Kroniaki cultivar produced a higher oil content 49.9% compared to Picual 40.4 % and Toffahi 20.4 % based on dry weight. Yet, Picual gave a higher soluble solids with lower acidity than those obtained form Kroniaki and Toffahi cultivars.

INTRODUTION

Olive (*Olea europea* L.) trees are the oldest cultivated trees grown in the world. There are about 8.5 million hectares, cultivated in the world about 98 % of these trees are growing in the Mediterranean area. The annual world production is about 9.4 million metric tons (MT), approximately 720000 MT of this production are consumed as pickled olive, and the remaining 8690000 MT are used for extraction of olive oil according to FAO (2004).

The olive fruits have high nutritive value and considered as important source for oil which can be used in nutrition and other medicinal purposes. Recently, olive becames one of the most important fruit crops in Egypt. Since, the total cultivated area is about 108299 feddan with total annual production 544640 MT according to the last statistics of Ministry of Agriculture (2006).

Several varieties are planted under Egyptian conditions such as Toffahi and Egazy which used for table olive, Picual and Manzanillo which used for table olive and oil extracting while Kroniaki and Chemlali are used for olive oil production. In this respect, Kroniaki had a higher oil content than Picual olive cultivar Abou-Aziz *et al*. (2001) and EL-Said *et al*. (2006). Furthermore, Singh & Kar (1980) mentioned that cross-pollination is necessary for olive production.

Therefore, this study was undertaken to evaluate pollen viability, fruit set dropping, yield and fruit quality of Toffahi, Picual and Kroniaki cultivars grown under newly reclaimed soils of Egypt.

MATERIALS AND METHODS

The present investigation was carried out during the seasons of 2005 and 2006 on three olive cultivars (Toffahi, Picual and Kroniaki) grown under newly reclaimed soils in Egypt. The trees were ten years old grown in a private orchard at El-Khatatba, Monofia Governorate, Egypt. The three olive

cultivars are grown in sandy soil under drip irrigation and planted 5 m apart between trees and 6 m between rows.

A complete randomized block design was used represented by 4 trees per each plot and replicated four times. Trees from each cultivar were received the normal horticultural practices in the orchard.

Determination of pollen viability :

Samples of flower clusters of each cultivar were collected to test their pollen viabilities by using agar–water medium consisting of 2% agar and 15% sugar **(**Griggs *et al*. 1975). The viable ones were well stained and counted and the percentage of pollen viability were estimated according to EL-Agamy *et al*. (1982).

At the beginning of flowering, number of flowers on four new shoots was counted from each cultivar and at petal full the number of fruit were counted to estimate the initial fruit set. Furthermore, when the fruits reached normal size, the number of remained fruits was counted to estimated average fruit set.

Fruit set :

1- Initial fruit set percentage (IFS) :

The percentage of initial fruit set was calculated after 20 days of pollination as :

$$\text{IFS \%} = \frac{\text{Number of fruits}}{\text{Total number of perfect flowers}} \times 100$$

2- Final fruit set percentage (FFS) :

Number of retained fruits of normal size at harvest was determined and FFS percentage was calculated as :

$$\text{FFS \%} = \frac{\text{Number of fruit at harvest}}{\text{Initial number of fruit at FFS}} \times 100$$

Fruit dropping :

It was estimated by counting the number of fruits after 20 days of fruit set and retained number of fruits at harvest and the percentage of fruit drop were calculated as follow :

$$\text{Dropping \%} = \frac{\text{Total No. of fruits - No. of remaining fruits}}{\text{Total No. of fruits}} \times 100$$

Yield per tree and per feddan :

Yield per tree was recorded by weighing fruits for each cultivar, and then average yield per feddan was estimated as average yield/tree multiplied by the number of trees per feddan (130 trees).

Fruit characteristics :

On late of October during the both seasons, 100 fruits from each replicate were taken at a random to determine :

1. **Average fruit weight :** it was determined by weighing samples of 100 fruits per each replicate and the average weight (gm) was recorded.
2. **Average fruit length and diameter :** Samples of 10 fruits per each replicate were used to determine average fruit length and diameter (cm) using vernier caliper.

Samples of about 50 gm of flesh fruit from each cultivar was extracted using 50 ml of water and then filtrated to determine:

1. **Soluble solids content :** it was determined by using hand refractometer.
2. **Total acidity :** 5 ml from flesh fruit extract was taken to determine total acidity which expressed as gm citric/100 gm flesh weight according to A.O.A.C (1975).

Oil content :

It was determined by extracting the dried flesh fruit samples using hexan at 60-80 ^{o}C boiling point as described by A.O.A.C. (1975).

Statistical analysis :

Results were subjected to analysis variance using Factorial experiment in a complete randomized design and L.S.D at 5 % was used for data comparison according to Snedecor & Cochran (1980).

RESULTS AND DISCUSSION

The present study aimed to evaluate Toffahi, Kroniaki and Picual olive cultivars grown under Egyptian conditions and the obtained results are presented as follow :

Pollen viability percentage :

Data from Table (1) indicated that pollen viability of Kroniaki olive cultivar was significantly higher than both Toffahi and Picual olive cultivars. Since, it presented about 94.0 % as a mean of the two seasons. Moreover, pollen viability of Picual was higher than Toffahi cultivar. The percentages of pollen viability were about 85.0 and 80.2 % for Picual and Toffahi cultivars.

Table(1): Pollen viability, initial and final fruit set of some olive cultivars.

Cultivar	Pollen viability %		Mean	Initial fruit set %		Mean	Final fruit set %		Mean
	2005	2006		2005	2006		2005	2006	
Toffahi	74.2	86.1	80.2	24.1	25.5	24.8	3.71	4.15	3.93
Kroniaki	92.3	95.7	94.0	48.3	45.1	46.9	4.89	6.53	5.71
Picual	82.0	88.0	85.0	25.4	29.8	27.6	4.57	5.26	4.92
L.S.D at 5 %	**3.25**	**3.37**	---	**1.65**	**1.92**	**---**	**0.26**	**0.35**	**---**

In this respect, Fouad *et al*., (1992a) reported that olive pollens were of good viability with germination percentage ranging from 31.0 to 91.0 %. Also, they mentioned that Kroniaki presented a higher fruit set than Picual and Toffahi cultivars.

Fruit set percentage :

From Table (1) it is clear that initial and final fruit set were significantly higher in Kroniaki olive cultivar than those obtained from Picual and Toffahi cultivars. Also, Picual olive cultivar gave a higher fruit set than from Toffahi cultivar. In this respect, the data presented that final fruit set values were about 5.7, 4.9 and 3.9 % for Kroniaki, Picual and Toffahi as a mean of two seasons. The increment in fruit set for Kroniaki was due to that pollen viability for this cultivar was higher than those obtained from the other two cultivars. Whereas, the reduction in fruit set percentage of Toffahi cultivar is due to the reduction of their pollen viability. Likewise, Griggs *et al*. (1975) reported that only about of 1-2 % of total number of perfect flowers may be required to set fruits and to establish a commercial crop.

Fruit drop percentage :

Data from Table (2) presented that the percentage of total fruit drop of Toffahi and Picual olive cultivars were almost higher than those obtained from Kroniaki cultivar during both seasons of the study. The increment of fruit drop for Toffahi than Kroniaki may be due to that Toffahi cultivar had heavier and bigger fruits than those of Kroniaki which has lighter and thinner fruits. From this data it is clear that a negative relation between fruit drop and pollen viability exists, since, Kroniaki olive cultivar had heavier pollen viability 94.0 % produced a lower fruit drop. Similar results were obtained by EL-Desouki (1993) and Briccoli *et al*., (2002).

Table(2):Fruit drop, yield per tree and per feddan of some olive cultivars.

Cultivar	Fruit drop %		Mean	Yield/tree (kg)		Mean	Yield/feddan (ton)		Mean
	2005	2006		2005	2006		2005	2006	
Toffahi	97.3	95.9	96.6	29.9	37.8	33.9	4.19	5.29	4.74
Kroniaki	95.1	93.5	94.3	35.6	44.2	39.9	4.98	6.16	5.57
Picual	95.4	94.7	95.1	28.1	36.2	32.2	3.93	5.07	4.50
L.S.D at 5 %	**1.11**	**1.65**	**---**	**3.49**	**4.12**	**---**	**0.34**	**0.48**	**---**

Yield/tree and per feddan :

Yield per tree (Kg) and per feddan (Ton) is presented in Table (2). The data showed that Kroniaki olive cultivar presented a highly significant yield per tree and per feddan than those obtained from Toffahi and Picual cultivars. In this respect, average yield of Kroniaki was about 39.9 Kg/tree and about 5.6 ton per feddan as a mean of two seasons. From this data it is clear that, the increment in yield per tree and per feddan of Kroniaki cultivar may be due that this cultivar had a higher pollen viability and percent of fruit set with lower fruit dropping with those presented from both Toffahi and Picual olive cultivars. Whereas, no significant differences on yield per tree

and per feddan between Toffahi and Picual olive which planted in this orchard during the both seasons of the study. Likewise, El-Said *et al*. (2006) mentioned that Kroniaki gave the heaviest yield (44.9 kg/tree) compared with Toffahi (40.7) and Picual (35.6).

Average fruit weight :

Data from Table (3) reveal that average fruit weight of Toffahi olive cultivar was significantly higher than those from Picual or Kroniaki cultivars, since the weight of Toffahi fruit reached about 11.6 gm. Also, average fruit weight of Picual was significantly higher than Kroniaki fruits, since the weight of Kroniaki and Picual fruit ranged about 0.94-5.2 gm, respectively as mean of two seasons.

Table (3): Fruit weight, length and diameter of some olive cultivars.

Cultivar	Fruit weight (gm)		Mean	Fruit length (cm)		Mean	Fruit diameter (cm)		Mean
	2005	2006		2005	2006		2005	2006	
Toffahi	12.18	10.94	11.56	3.21	2.59	2.90	2.75	2.85	2.80
Kroniaki	0.97	0.90	0.94	1.96	1.36	1.66	0.89	0.90	0.90
Picual	5.37	5.06	5.22	2.65	2.57	2.61	1.75	1.77	1.76
L.S.D at 5 %	**0.83**	**0.76**	**---**	**0.121**	**0.082**	**---**	**0.042**	**0.063**	**---**

From the obtained data it is clear that, in spite of Toffahi and Picual cultivars gave a higher fruit weight than Kroniaki cultivar but they showed a lower yield, that may be due to that average fruit set and number of fruits per tree was lower than Kroniaki cultivar. Similarly, El-Said (2006) mentioned that fruit weight ranged from 11.4 gm in Toffahi, 4.4 gm in Picual and 1.2 gm in Kroniaki. Such differences in fruit weight of olive cultivar were reported by Hartman and Papaioannou (1971) and Hussein *et al.*, (1999)

Average fruit length and diameter :

From Table (3) it is clear that both averages fruit length and diameter (cm) of Toffahi were almost higher than those obtained from Picual or Kroniaki cultivars. Whereas, Kroniaki presented lower significant values than the other two cultivars. Since, Kroniaki gave smaller and lighter fruit than Picual and Toffahi fruits. In this respect, El-Said *et al*. (2006) showed that Toffahi fruits recorded the highest values 3.1 cm in length and 2.7 cm in diameter. Whereas, Kroniaki exhibited the least values of fruit length 1.55 cm and 1.06 for fruit diameter.

Soluble solids content % :

It is obvious from Table (4) that Picual olive cultivar presented a higher SSC (13.3) while those obtained from Toffahi or Kroniaki cultivars gave a lower content of SSC in fruit juice (11.7 & 10.7), respectively.

Total acidity :

Data from Table (4) showed that total acidity gave an opposite trend to those obtained from SSC. So, Toffahi olive cultivar gave higher values of total acidity than those obtained from Kroniaki and Picual cultivars. Whereas, Picual produced a lower percent of total acidity during the both seasons.

Table (4): Soluble solids, total acidity and oil percent of some olive cultivars.

Cultivar	Soluble solids content %		Mean	Total acidity %		Mean	*Oil %		Mean
	2005	2006		2005	2006		2005	2006	
Toffahi	11.5	11.8	11.7	0.514	0.613	0.564	22.1	18.7	20.4
Kroniaki	10.3	11.1	10.7	0.372	0.431	0.402	50.9	48.9	49.9
Picual	12.7	14.4	13.3	0.323	0.362	0.343	39.6	41.2	40.4
L.S.D at 5 %	**0.70**	**0.73**	**---**	**0.073**	**0.082**	**---**	**1.39**	**1.52**	**---**

*** Calculated as dry weight.**

From this data it is clear that, in spite of Picual olive cultivar presented a higher soluble solids content than both Toffahi and Kroniaki, but gave a lower acidity than the other cultivar.

Oil content :

Data from Table (4) presented that oil content of both Kroniaki and Picual were significantly higher than those obtained from Toffahi cultivar. In this respect, average oil percent was about 49.9 % estimated as dry weight for Kroniaki but it presented about 40.4 and 20.4 for Picual and Toffahi olive cultivars. From this data it is clear that, Toffahi is used as Table cultivar but Kroniaki for oil production. Yet, Picual is used for both Table and oil extraction. The obtained results are in line with those reported by BalatSouras (1984) who mentioned that Kroniaki, Picual, Frantoio and Razolla are specific for oil production. Also, Raina *et al.* (1986) suggested that the best suitable olive cultivars for oil production have medium size which their fruits contain a bout 15 - 40 %. Furthermore, Fouad *et al*. (1992b) found that Kroniaki had a higher percentage of oil content (48.1 %) with a good oil olive under Egypt conditions comparing with Toffahi cv. which gave lower values 22.9 %.

From this study it is clear that, Toffahi gave a higher weight of fruits but presented a lower yield per tree and per feddan due to the reduction of fruit set. Whereas, in spite of Kroniaki cultivar presented a lighter weight of fruits but gave a higher yield than Picual due to higher fruit set.

The present study emphasized the importance of Kroniaki cultivar which presented a higher yield and oil content than Picual and Toffahi cultivars. So, to achieve better income from olive cultivation it is suggested to concentrate on Picual cv. for pickling and oil extraction, while Kroniaki for oil and Toffahi for pickling because its bigger size and low content of oil. Growing more than one cv. in the olive orchards is of almost importance to insure good pollination, fruit set and higher yield.

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تقييم بعض أصناف الزيتون تحت الظروف المصرية

نبيل رشاد سمره* ، سمير زكى العجمي و باسم نبيل سمره***
*** قسم الفاكهة – كلية الزراعة – جامعة المنصورة- مصر**
**** قسم البساتين – كلية الزراعة – جامعة أسيوط – مصر**

أجريت هذه الدراسة خلال موسمي ٢٠٠٥ & ٢٠٠٦ لتقييم سلوك ثلاثة أصناف من الزيتون (تفاحي – كورناكى – بيكوال) منزرعة في الأراضي الجديدة في مصر وذلك من خلال تقييم حيوية حبوب اللقاح وكذا نسبة العقد والتساقط والمحصول وخواص الثمار.

ولقد أوضحت الدراسة أن صنف الزيتون الكورناكى أعطى أعلى محصول ٤٤,٢ كجم/شجرة مقارنة بمحصول كل من صنفي الزيتون التفاحى والبيكوال إذ أعطى محصول ٣٧,٨ & ٣٦,٢ كجم للشجرة خلال موسمي الدراسة على التوالي .ولقد أوضحت النتائج أيضاً أن حيوية حبوب اللقاح وكذا نسبة عقد الثمار كانت مرتفعة في صنف الزيتون الكورناكى بالمقارنة بصنفي الزيتون التفاحى والبيكوال كما أن متوسط وزن وحجم الثمار في الصنف التفاحى كان مرتفعا بالمقارنة بكل من البيكوال والكورناكى وبلغت نسبه الزيت ٤٩,٩ % في الصنف كورناكى في حين أعطى صنف الزيتون البيكوال ٤٠,٤% بينما أعطى صنف التفاحى أقل نسبه من الزيت ٢٠,٤ % مقدرة على أساس الوزن الجاف.

علاوة على ما سبق فإن صنف الزيتون البيكوال أظهر قيماً مرتفعة في نسبة المواد الصلبة الذائبة مع انخفاض في محتوى عصير الثمار من الحموضة الكلية مقارنة لما تحصل عليه في صنفي الزيتون التفاحى والكورناكى.

مما سبق يمكن التوصية بالتوسع في زراعة أصناف الزيتون التي تصلح للزيت مثل الكورناكى إذ أنه يعطى إنتاجية أفضل وكذا نسبة زيت عالية وبالتالي يحقق عائد إقتصادى مرتفع بالنسبة للمزارع تحت الظروف المصرية.