



RESEARCH ARTICLE

FLOWERING, POLLINATION AND FRUITING OF SOME INTRODUCED OLIVE CULTIVARS IN
AL-JOUF REGION

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Abbreviations:

cv-Cultivar; KSA- Kingdom of Saudi
Arabia; FW- Fruit growth;
WAFS-Week After the Fruit Set.

ABSTRACT

Background: The expansion of the olive cultivation resulted in the north of the Kingdom of Saudi Arabia (KSA) to import many cultivars from several countries and planted, which requires the study of the impact of environmental conditions on these cultivars and their success.

Materials and Methods: The present study was carried out during 2004 and 2005 growing seasons on five olive cultivars (*Olea europaea* L.). The aim of this study was to evaluate the important olive cultivars introduced recently for cultivation in the North Kingdom of Saudi Arabia. These cultivars are Manzanilla, K18, Sourani, Nabali and Picual growing in the project of the Al-Jouf Agricultural Development Company in Bosita, Ten trees (as a replicates) were selected of similar size and age (about 10 years) from each cultivar. The tested trees received the same agro-technical practices adopted in this district. The following characteristics were studied: flowering and fruiting the results of the study show that the species differed among themselves in a lot of floral traits and fruiting.

Results: cv. Picual was an outstanding first qualities crop (fruits, oil) for the tree with the qualities of a good fruiting making it the best cultivars for the extraction of oil as well as excellence cv. Manzanilla qualities of fruits and this makes it even better for dual-purpose items and was a cv. Sourani best by the oil in the fruit so it is recommended to these three cultivars of superiority over the rest of the cultivars, it can also take advantage of the cultivars of k18 and indifferent of Nabali for pickling.

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INTRODUCTION

Olive was known in northern Saudi Arabia (KSA) Aljouf region of in the history where olive cultivation in Domat aljandal in the thirteenth century and was King Ekidur bin Abdul Malik has brought it from Hirra (Iraq) to Aljouf I in the first years of prophet Muhammad immigration, in recent years has been a significant expansion in olive cultivation in north KSA where appropriate environmental conditions in Aljouf, Tabuk and Hail regions and this expansion as a result of the interest of companies and major projects and farmers in this blessed tree and they have been done some of the seminars for olive and hosting experts and specialists with the government support which led to import and cultivated of a number of table olive and oil cultivars or dual-purpose, Despite the amount of flowers that olive tree gives are enough to produce a good crop, but that many of the orchards drop in the fruit set and fail to provide a commercial crop, where the temperatures

requirements affect during the growing season at the date of the blossoms, consistency, sex ratio of the flowers, the formation and germination of pollen, the occurrence of fertilization, the proportion of the fruit set and the crop (Griggs *et al.*, 1975; Martin, 1990; Martin, 1994) However, due to the lack of previous studies on the olive cultivars introduced in the north of KSA The current experiment was conducted to find out the flowering, pollination and fruiting of some introduced olive cultivars in Al-Jouf region. Olive flowers either perfect or male flowers and this ratio influence by cultivar and season, Despite the amount of flowers is enough to produce a good crop even if the fruit set only 5% of them, However, various of olive groves has drop of the fruit set percentage and fail to give a commercial crop only when cross pollination between cultivars of olive cultivars also differ in floral dates, fruit set, fruit measurements, even fruit maturity, fruit moisture, oil content on fresh basis and dry weight and quantity of the crop (Besnard *et al.*, 2000). The date of flowering in olive trees is variable as a result of cultivar and climatic conditions, and one year to another of the same cultivar depend of spring temperatures, if it is cold and wet the full flowering delayed to the first of June. However, if the temperature is high in the

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month of April and May, the flowering rapidly completed in the first of May. (Fouad *et al.*, 1992 a; Hassan, 1996; Hassan, 2000; Ghieth, 2003), And the number of flowers in inflorescence is ranging between 8-25 flower, depending on the environmental conditions, cultivars and nutrient condition of the tree, (Martin, 1990; Martin, 1994). Sex expression ratio of perfect flowers also differ from cultivar to another and ranged from 24.26% to 67.27%, (Eassa, 1993; Laz, 1993). Furthermore, (Hussein *et al.*, 1999) found the highest proportion of perfect flower was between 86-96% in the cultivars of Koratina, Nabali Mohsen, Nabali saadah Bischolin, and the lowest ratio was between 52-58% in cultivars of Karadalia and Konservollaa.

The phenomenon of incompatibility be clear in some olive cultivars and affect a lot of the fruit set proportion, where (Rallo *et al.*, 1990) studied this phenomenon on three cultivars of Murayolo, Manzanilla and Frantoio where they found the phenomenon of incompatibility, and when they did cross pollination for the same cultivars were gave the best ratio of fruit set. Another study, also conducted on some cultivars and was found in female sterility, including cultivar of Manzanillo, and it has overcome this problem by cross pollination, (Cuevas and Rallo, 1990). As well as a study has shown the low proportion of the fruit set due to the phenomenon of flower male sterility (Besnard *et al.*, 2000). Also, the study of (EL-Wakil *et al.*, 2001) has shown the self sterility in the five cultivars of olives and found some chromosomal abnormalities during Meiosis division and this illustrates one causes of olive flower sterility. However, It was found that the proportion of fruit set between 1.01% in cv. Karonaki to 6.83% In cv. Frantoio, (Marco *et al.*, 1990; Androulakis and Loupassaki, 1990)

The olive fruit growth has followed three phases, initially fruit growth is rapid followed by slow growth period which is pit hardening, then the growth of fruit has rapid and the fruit color has been changed from green to bluish, and this growth period from 26 to 28 WAFS (Ghieth, 2003; Hussein, 1999b), Olive fruits parameters are influenced by region in terms of size, weight, dimensions and seed weight in addition to the content of the fruit of the oil and water and were an inverse relationship between them. Moreover ranging fruit weight from 12 to 2 gm and length from 0.6 to 3.52- cm and weight of seed ranges from 0.25 to 0.95 gm due to the cultivars (EL-Wakil *et al.*, 2000; Trigui, 1996; Lababidi, 1991; Fouad *et al.*, 1992 b). Pulp ratio varies from cultivar to another as well as by location and the highest cultivar of fruit weight was the same of the highest cultivar of pulp ratio which ranging from 80.1 to 85.2% (Laz, 1993; Hassan, 1996; Hussein *et al.*, 1999)

Also, (Fouad *et al.*, 1992 b) has found wide variations of fruit oil content basis of fresh weight which increased with the development of fruit growth up to reach to the fruit stage of black color, and fruit oil content ranged from 5.15% in cv. Toffahi to 26.4% in cv. Kronaki, (Laz, 1993) and the stability of oil proportion was proof of maturity completed, As well as (Ghieth, 2003) found that the oil ratios on a dry weight basis it was clearly different between studied cultivars for two seasons and was the highest in cv. Koratina 62.9% and was the lowest was cv. Nabali saadah 39.15%. Olive fruit moisture proportion was be different in 35 cultivars and was an average from 63.28% to 61.54% (Fouad *et al.*, 1992 b). In addition, (Martin, 1994) found the highest fruit moisture proportion in cv. Nabali Mohsen 65.8% and the lowest in Bischolin 44.9%, and it found

there were differences in the productivity of the crop, depending on the cultivar and the best were cvs. Konservollaa and Tanche and the lowest were cvs. Sourani and Julat. (Maracchi *et al.*, 1994) has a illustrated a relationship between rainfall rate and the summer heat and the amount of production of olive fruit. This study aims to evaluate flowering, pollination, fruiting, oil content, yield and to determine the degree of optimal harvest date of major cultivars introduced under the new environment conditions in Aljouf region.

MATERIALS AND METHODS

This study was conducted on five cultivars of olive trees (Manzanillo, Picual, Sourani, Nabali, K18) introduced from Spain, Syria, Jordan respectively and growing aged 8-10 years, at distances of 7×7 in successive seasons in 2004 and 2005 in project of Jouf Agricultural development company in the region of Aljouf, which located west of Sakaka city about 200 kilometers. Ten trees were considered as an experimental unit of each cultivar under same agricultural practices and has been the studied of the following characteristics.

Flowering

Beginning of flowering It has been scheduled by monitoring inflorescences continuously then determined full bloom (when 75% of the open flowers), Density of flowering has estimated by meter and number of flowers on inflorescences has accounted from along the five branches as range for 50 in inflorescences of the tree. The ratio of perfect flowers, has been calculated the number of full flower from 50 inflorescences on each 10 trees for each cultivar (replicates) and then the average sex ratio has recorded.

Sex ratio full of flowers = number of full floral / total number of flowers $\times 100$

The germination of pollen has been accounted by collecting pollen five inflorescences from each 10 trees (replicates) germinate on agar environment described by (Albert, 1930). After 3 hours and then 24 hours later as follows.

Germination percentage = number of pollen germinated / total number of pills vaccine $\times 100$

Fruit set

Fruit set was identified five branch from each 10 trees (replicates) and flowers has accounted then after flowering stage by two weeks the fruit number was taken and calculated the proportion of the fruit set.

Proportion of the Fruit set = number of fruit set/ number of flowers $\times 100$

Fruiting

It was followed up fruits growth by taking 10 fruits of every tree of the studied trees and then every 15 days after the fruit set by 4 weeks until full ripening has been estimated weight of the fruit and seed weight was calculated from the ratio of pulp for each category are as follows, It assesses the degree of maturity has been through three stages: at the beginning of the coloring of the fruits of up to 25%, 50% and 75%, and the samples it have taken from each stage. The fruit weight, stone

weight and pulp weight were expressed in grams (g) by measuring with a digital balance, the pulp and stone ratio was calculated by dividing the pulp weight with corresponding stone weight. A sample of 100 fruits was used to measure the fruit weight and the pulp as well as stone weight which was measured by using 10 randomly selected fruits from each replication. To measure the fruit volume, 100 fruits were submerged in 500 mL of water contained in a graduated one litre measuring cylinder (Fortuna, Germany) and the volume was recorded as the volume of displaced water in cm^3 .

The intensity of the fruit = fruit weight / size of the fruit

Pulp weight = weight of the fruit - the seed weight

Pulp ratio = weight of pulp / fruit weight \times 100

Fruit length and width

The fruit length and width of 100 fruits per replication randomly selected fruits were measured in millimetres (mm) by using a digital calliper and the average value was calculated.

Shaped fruit = fruit length / width of the fruit.

Olive oil content and moisture (%) in the fruit

Olive fruit (composite sample of 1.5 to 2 Kg) were harvested on the selected days

Olive oil content in fresh fruit was determined by following the method described by (Avidan *et al.*, 1999) with some modifications. Olive fruit paste (10g) was taken in each replication after crushing the olive fruit. The content was dried in an oven at 80°C for 24 h and the dry weight of each replicate was recorded for moisture percentage.

Fruit moisture = wet weight of the sample - dry sample weight

Oil dry weight basis = weight of oil extracted / weight ratio of the sample (10 grams) \times 100.

Fruit dry matter (%) = weight of the dried fruit \times 100/weight of the fresh fruit sample.

Oil yield = weight of the tree crop / 100 \times oil content of fruits wet (Avidan *et al.*, 1999).

The weight of the tree crop

It has been estimated for each tree crop, as the weight of the crop was 10 trees (replicates) for each cultivar where they were harvesting manually according to the method used in the harvesting of agricultural companies in the region.

Statistical design

Statistical analysis has been implemented using a complete design random number ten replications of five cultivars of olive trees, and has been compared to averages less significant difference in the abstract. 0.05, (Steel and Torrie, 1980) were analyzed the results using the statistical SAS software (SAS Institute (1985)).

RESULTS AND DISCUSSION

Flowering

The results showed in Figure (1) that the beginning of flowering vary between cultivars and seasons where was in all studied cultivars restricted from April 2 until April 15 in the first season, 2004, and April 16 until May 4 for the second season, 2005 and this result consistent with (Griggs *et al.*, 1975; Fouad *et al.*, 1992 a; Hassan, 1996) that the flowering time in a Changing olive trees by cultivar and climatic conditions because temperatures for spring so that if the cold and wet spring delayed the full flowering to the first of June and in If there are high temperatures in April and May, which full bloom completed in the first of May .The first flowering was in Manzanilla on 2th to 4th of April in, 2004, and was the last cv. is Picual in May 2 to 4 in 2005, and these results are consistent with what was said (Hassan, 1996; Ghieth, 2003) about cv. Manzanilla which begin of flowering and cv. Picual is most recently, it also found that the differences between the cultivars and seasons, and the number of flowers in inflorescence in five cultivars in the seasons between 12.42 - 9.62 Flower was the largest average number of flowers in inflorescence in cv. Sourani 12.42 and was the lowest cv. Nabali 9.62 flower for two seasons and these results agreed with result of found (Griggs *et al.*, 1975; Hassan, 1980; Hassan, 1996; Martin, 1990; Martin, 1994) where it was stated that the average number of flowers in the inflorescence ranges between 12-18 flower varies by cultivar. Furthermore, the results showed in Figure (2) sex ratio differs for percentage of perfect flower morally between studied cultivars ranged between 65.95-24.21% and the highest was in cv.Nabali 65.95 - 61.06% and lowest was in cv. Manzanilla 24.21 - 25.01% and that for two seasons from 2004 to 2005 m, respectively, These findings are consistent with (Fouad *et al.*, 1992 a; Eassa, 1993; Ghieth, 2003) thoughtful in 35 cultivars from 14.6% to 80.2%.

Fruit set

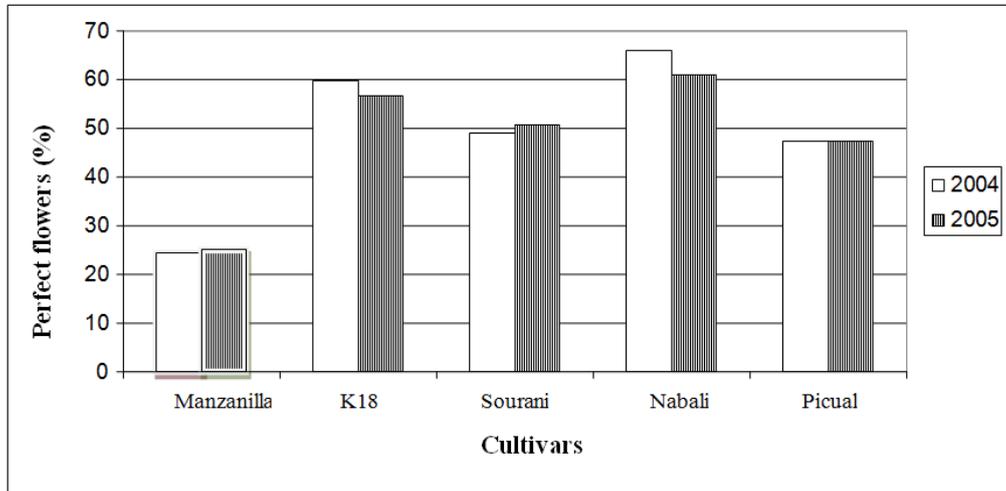
Results showed in Figure (3) significant differences in the studied cultivars in the proportion of fruit set with the highest results in cv. Sourani 6.59 - 7.5% and the lowest cv. Manzanilla 5.10 - 5.53%, and that for two seasons 2004 to 2005 respectively, and these findings are consistent with what (Hassan, 1980; Androulakis and Loupassaki, 1990) where found that the fruit set for the cultivars studied ranged between 5.54 - 10.26% and 4.98 6.4% respectively.

Fruit growth development

The results showed in Figure (4) the fruits of the two seasons growth rate by measuring the weight of the fruit from the beginning of the fourth week after the fruit set (WAFS) and it was earlier in 2004 season by two weeks than 2005, and growing season was 24 weeks for all cultivars from the fruit set until full maturity, except cv. Picual spans 26 weeks, Moreover, the most important period of growth than other was from mid-May to mid-July and these results are consistent with what was said (Hussein, 1999b). However, cv. Manzanilla was highest value of the weight of the fruit in the three stages of maturity of 5.23 g and the lowest was cv. Sourani 3.2 gm as range for 2004 and 2005. These result consistent with (Eassa, 1993; Lababidi, 1991; Hussein, 1999b).

Table 1. Begging of flowering date of some introduced olive cultivars in Aljouf-region in 2004-2005

Begging of flowering date		
CULTIVAR	2004	2005
Manzanilla	2-4 April	16-17 April
K18	6-8 April	21-23 April
Sourani	10-11 April	25-27 April
Nabali	10-11 April	25-27 April
Picual	14- 15 April	2-4 May

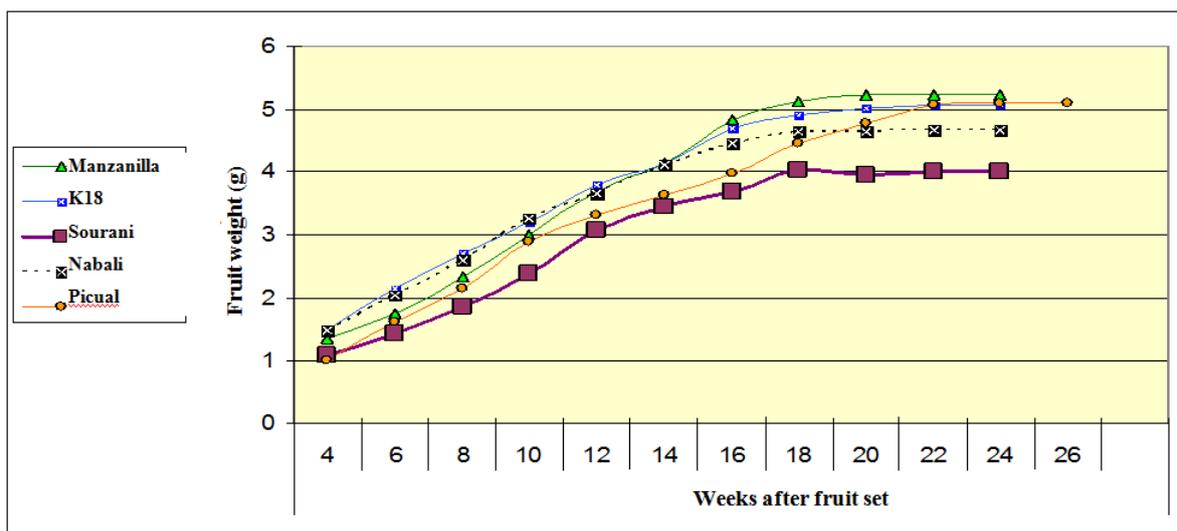


LSD ($P \leq 0.05$) in 2004 = 0.88 *
 LSD ($P \leq 0.05$) in 2005 = 0.81*

Fig.1. Perfect flower of some introduced olive cultivars in Aljouf region in 2004-2005

Table 2. Fruit set of some introduced olive cultivars in Aljouf region in 2004-2005

Cultivars	Fruit set %	
	2004	2005
Manzanilla	5.10	5.53
K18	6.56	6.04
Sourani	6.59	7.5
Nabali	5.60	5.83
Picual	6.52	4.94
LSD ($P \leq 0.05$)	0.15	0.18



LSD ($P \leq 0.05$) CVS = 0.031 *
 LSD ($P \leq 0.05$) FW = 0.040*
 LSD ($P \leq 0.05$) FW × CVS = 0.089*

Fig. 2. Fruit growth as weight of some introduced olive cultivars in Aljouf region in 2004-2005

Table 3. Tree yield some introduced olive cultivars in Aljouf region in 2004-2005

Cultivars	Yield weight per tree (kg)	
	2004	2005
Manzanilla	37.97	22.72
K18	38.14	20.88
Sourani	28.34	17.82
Napali	35.66	13.18
Picual	89.86	36.82
LSD ($P \leq 0.05$)	3.21	2.82

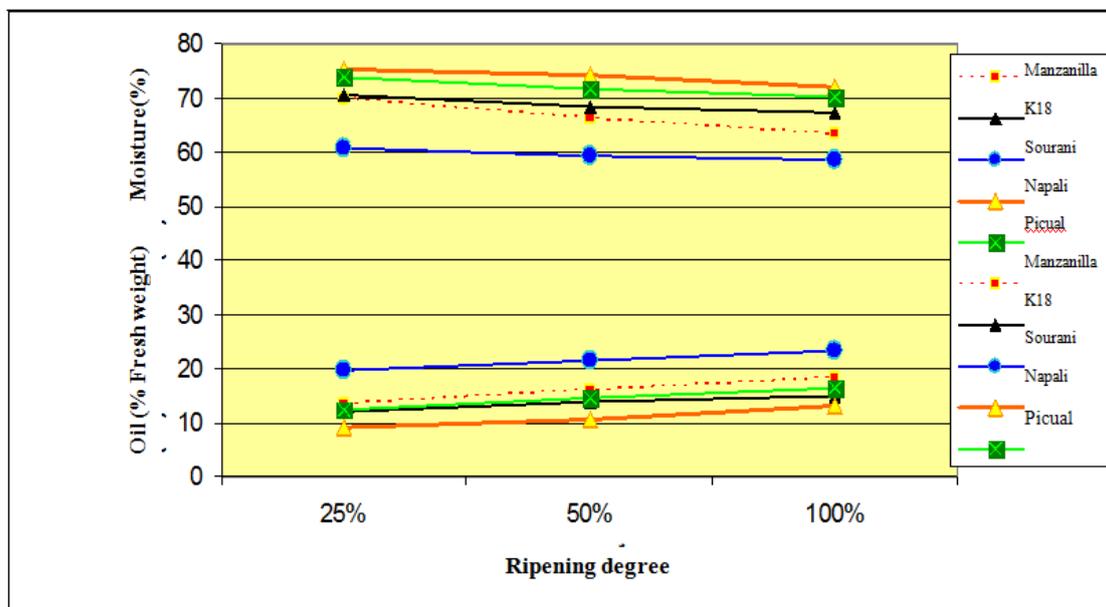


Fig.3. Moisture and olive oil content in fresh fruit weight of some introduced olive cultivars in Aljouf region in 2004-2005

The fruit pulp has been increased with the progress of the age of the and the highest average of pulp percentage was in cv. Manzanilla and cv. k18 for all periods, amounting to 82.15% of the average two seasons however, cv. Sourani has lowest average of fruit pulp 80.35% for two seasons. Moreover, the highest values of the average of last three stages of maturity cv. Manzanilla rose to 87.57 % and the lowest in cv. Sourani 84.32 % for two seasons 2004 and 2005 m respectively, and these results largely in line with what (Fouad *et al.*, 1992b) found of the average the proportion of pulp in all studied cultivars 84.8% .

Oil content of fruit

The results showed in Figure (5) Olive oil content (% fresh basis) between the stages of the three maturity where the results showed that the percentage of oil increases with fruit ripening in the three phases of the study where excelled last stage (coloring 100%) of the highest values the percentage of oil as the average proportion of oil for two seasons, 17.22%, and lowest with (Coloring 25%) and the average oil content of the seasons is 13.52%, and this was confirmed by (Fouad *et al.*, 1992 b; Hussein *et al.*, 1999) that the percentage of oil content in the fruit growing with the development of fruit growing and has a range upon the arrival of the fruit to the stage of black color (coloring 100%) and the highest value for two seasons in a cv. Sourani third stage 23.46% and the lowest value was in cv. Nabali in the first stage of amounted 9%. Furthermore, Olive oil content (% dry basis) was no differences apparent between seasons and the highest average was in Sourani third stage 56.49% and the lowest value in the cv. Nabali 37.07% and consistent this results in varying cultivars by oil dry weight

of the fruits with what found many researchers (Shahein *et al.*, 1982; Fouad *et al.*, 1992 b; Ghieth, 2003).

Fruit moisture percentage

The results shows in Figure (5) fruit moisture percentage observed the differences between the cultivars and between the stages of the three maturity and there is no differences apparent between seasons where the moisture is gradually decreased with the increase in fruit ripening, where given the first phase (Coloring 25%), the highest value the fruit moisture for two seasons 70.01%, and lowest final stage (coloring 100%) was 66.06% for two seasons and was the highest value recorded in the cv. Nabali in first phase of 76.19% and the lowest value in the cv. Sourani in third stage 58.34% and these results agreed with result of (Fouad *et al.*, 1992 b; El-Mahdy and Rashwan, 1997; Ghieth, 2003).

Yield per tree

The results showed in Figure (6) the olive fruit yield per tree in the two seasons 2004 and 2005. And was 2004 the highest value and was cv. Picual the highest value yield of the tree 89.86 kg in 2004 and 36.82 kg in 2005, and was the lowest value in the cv. Sourani, 28.34 kg in 2004 and 17.82 kg in 2005. And these result consist with of (Abdel Aziz *et al.*, 1982; Ghieth, 2003). Also, many researchers (Shahein *et al.*, 1982; Sari and Fadi, 1977) found differences in weight between the tree crop cultivars and between seasons.

Conclusion

This study show that the cultivars differed among themselves in a lot of floral traits and fruiting and was a cv. Picual is an

outstanding first of crop quantity (fruits, oil) for the tree with the qualities of a good fruits and extraction of oil. However, the cv. Manzanila was the best fruit characters which excellent for dual-purpose, Also cv. Sourani was the best varieties by the oil percentage in the fruit so it is advisable to these three varieties of superiority over the rest of the cultivars, it can also take advantage of the cv. k18 and cv. Nabali as table olive cultivars.

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