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# STUDIES ON FLOWERING AND FRUIT SET OF SOME OLIVE CULTIVARS UNDER ASSIUT ENVIRONMENTS*

## B- THE EFFECT OF POLLINATION SYSTEM ON PHYSICAL CHARACTERISTICS OF FRUITS

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## ABSTRACT

**This experiment was carried out on four olive cultivars namely, Kronaiki, Cairo 7, Wardan and Frantoio during 3 successive seasons (1996, 1997 and 1998) at the experimental Orchard of the Faculty of Agricultural, Assiut University.**

**The present investigation aimed to study the relationship of mating system in the studied cultivars with fruit properties : fruit weight, flesh weight and its percentage seed weight.**

- **Kronaiki and/or Frantoio cultivars are best grown in a single orchard as they self-set fruits with high fruit weight compared to cross-pollinated either together or with other male parents. For better fruit weight in Cairo 7 and/or Wardan cultivars, Kornaiki would be the best pollinizer for such cultivars.**
- **Mating system was found not to affect flesh weight percentages. Selfing vs. cross pollination did not show generally significant differences in such character. On the other hand, selfing of Frantoio (bagging and/or hand selfing) induced lower flesh weight compared to cross pollination.**
- **Fruit shape of Frantoio cv. was found to be significantly influenced by mating system, selfing of Frantoio cv. produced fruits with less height/diameter ratio than cross and open pollination. Such observation could not be observed in other cultivars.**
- **Seed weight was found to be influenced by mating system only in Kronaiki and/or Frantoio cultivars but at opposite directions while in Cairo 7 and Wardan cultivars no particular trend was found.**

**The present study emphasized the importance of cultivar selection suitable to Assiut site as Kronaiki, Frantoio and Wardan (but not Cairo 7) in**

**addition to varietal combination in mixed plots. Kronaiki proved to be superior male parent under the experiment conditions.**

Key words: ***Olive, Olea europea , Mating system, Pollination, Fruit characteristics,***

## INTRODUCTION

It was believed that olive (*Olea europea* L*)* originated in Crete and was introduced from Crete to Egypt around 1800 B.C. (Anagnostopoulos 1951). Its cultivation spread from Greece or North Africa to Italy and to other Mediterranean countries around 600 B.C. (Goor 1966 and Hartmann and Bougas 1970).

Olives helps to combat problems of environment and its protection that are currently of concern to nation authorities and international organizations (Denis 1977). Also olive tree is considered as an important crop which can thrive successfully under dry conditions (Bailey 1961) and therefore would be a good solution to desert type and reclaimed soils. Olive fruits are used for oil extraction and for pickling. The oil proportion in the fruit, ranged from 35 to 70% on dry weight basis (Williams 1966, Sonntag 1979, Rana and Ahmed 1981 and Balatsouras, *et al* 1988).

Many olive trees fail to set satisfactory yield due to pistil abortion resulting in lack of sufficient numbers of perfect flowers (Hartmann, 1950) or for problems associated with pollination (self pollination and / or cross pollination among cultivars).

Olive acreage in 1997 was estimated by 87,083 feddans producing about 220,412 tons (average 3.78 tons/feddan). Nevertheless, there were 58,331 feddans in production (66.98% of total area) and the rest (28,752 fed) are considered unfruitful yet. New reclaimed area (out of the valley) planted with olive was estimated by 57,738 feddans representing 66.30% of total area of olive plantation in Egypt.

Middle and Upper Egypt Governorates contributed 17.56% of nation olive area (15,294 feddans). Olive is found to be spread southward to Qena while no record of olive plantation in Luxor and Aswan (Statistics Dept., Ministry of Agriculture 1997). Although the latest statistics showed that Assiut has only 230 feddans, about 1,200 feddans have been already planted with olive during the last few years in the reclaimed soils east of Assiut in the Assiuti Valley and expected to be more. Such shortage in olive area in the south of Egypt might be due to lower productivity of olive tree. Therefore,

the present investigation is considering some of factors that would shed some light on problems associated with olive tree productivity under Assiut environments in particular the relationship of mating system in the studied cultivars with fruit physical characteristics

## MATERIALS AND METHODS

This investigation was carried out on four olive cultivars namely, Kronaiki, Cairo 7, Wardan and Frantoio through three successive seasons (1996, 1997 and 1998) at the Experimental Orchard of the Faculty of Agriculture, Assiut University. Uniformly vigorous trees were randomly selected from each cv. Such trees were 11 years old and planted at 5x5 meters apart, in a clay soil.

Out of the four selected cultivars, Kronaiki, Cairo 7 and Frantoio are known as oil producing cultivars and Wardan is double purpose cv. Data were recorded for the following parameters as follows:

**Pollination studies**

The following matings were made for each cultivar as follows:

a - Open pollination. b - Bagging only.

c - Hand selfing d - Cross pollination by other selected cultivars.

These treatments were applied in a complete randomized design with four replicates.

For the open pollination treatment, the flowers were left under the natural conditions of the orchard. In bagging flowers were covered with cloth bags prior to flower opening.

For hand selfing, the pollens grains of the same cultivar were used for pollinating after flower emasculation and flowers were then covered with cloth bags.

For cross-pollination, the pollen grains of each cultivar were used for pollinating the other female cultivar and flowers were covered with cloth bags. Pollen was applied to the stigma of the emasculated flowers at balloon stage (prior to opening) by shaking the paper bags containing pollens.

After 20 days of pollination, the protecting cloth bags were removed. In each fruit sample, the following parameters were determined:

1 - Fruit and flesh weight values and percentages.

2 - Fruit dimensions, height, diameter and fruit index.

3 - Seed weight.

Statistical analysis and comparison among means were made using L.S.D. test at 5% level according to Steel and Torrie (1980).

## RESULTS AND DISCUSSION

### Physical characteristics

### Fruit weight

The data presented in Table (1) showed that bagging and hand selfing pollination of Kronaiki gave the best results and they have high significant effect compared with other treatments. The lowest value of fruit weight in Kronaiki cv. was observed when crossing was made using pollen taken from Cairo 7 cultivar.

**Table 1. Effect of different pollination treatments on fruit weight (g) in . Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons.**

| Cultivar / Pollination | | Open | Bagging | Hand selfing | Cross pollination (♂) | | | L.S.D. 0.05 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Cairo 7 | Wardan | Frantoio | |
| Kronaiki | 1996 | 0.69 | 0.92 | 0.88 | 0.38 | 0.51 | 0.64 | 0.05 |
| | 1997 | 0.69 | 0.91 | 0.94 | 0.37 | 0.52 | 0.64 | 0.04 |
| | 1998 | 0.76 | 0.94 | 0.91 | 0.43 | 0.54 | 0.66 | 0.04 |
| | Avg. | 0.71 | 0.92 | 0.91 | 0.39 | 0.52 | 0.65 | |
| | | | | | Kronaiki | Wardan | Frantoio | |
| Cairo 7 | 1996 | 1.33 | 1.35 | 1.37 | 1.65 | 1.22 | 1.20 | 0.07 |
| | 1997 | 1.33 | 1.37 | 1.38 | 1.58 | 1.25 | 1.24 | 0.03 |
| | 1998 | 1.32 | 1.45 | 1.45 | 1.72 | 1.26 | 1.25 | 0.12 |
| | Avg. | 1.33 | 1.39 | 1.40 | 1.65 | 1.24 | 1.23 | |
| | | | | | Kronaiki | Cairo 7 | Frantoio | |
| Wardan | 1996 | 2.63 | 2.26 | 2.27 | 2.87 | 2.09 | 2.17 | 0.07 |
| | 1997 | 2.56 | 2.30 | 2.32 | 2.92 | 2.09 | 2.16 | 0.16 |
| | 1998 | 2.50 | 2.40 | 2.40 | 2.95 | 2.07 | 2.20 | 0.05 |
| | Avg. | 2.56 | 2.32 | 2.33 | 2.91 | 2.08 | 2.18 | |
| | | | | | Kronaiki | Cairo 7* | Wardan | |
| Frantoio | 1996 | 1.55 | 2.06 | 2.17 | 1.69 | - | 1.62 | 0.08 |
| | 1997 | 1.50 | 2.00 | 2.09 | 1.63 | - | 1.58 | 0.07 |
| | 1998 | 1.66 | 2.21 | 2.14 | 1.74 | - | 1.70 | 0.06 |
| | Avg. | 1.57 | 2.09 | 2.13 | 1.69 | - | 1.63 | |

*** No fruit set**

The highest value of Cairo 7 fruit weight was observed when it was pollinated by Kronaiki pollen.

From the obtained data for Wardan cv. it could be observed that crossing with Kronaiki pollen gave the heaviest fruit followed by open pollination. Crossing with Cairo 7 gave the lowest value of fruit weight.

Concerning the average of fruit weight of Frantoio cv. it could be observed from Table (1) that bagging and hand selfing gave the best results. No fruits set from Frantoio cultivar when it was pollinated by Cairo 7 cultivar.

In general, based on fruit weight data, it can be concluded that Kronaiki and/or Frantoio cultivars could be best grown in single orchard as they self set fruits with high fruit weight compared to cross-pollination. For better fruit weight in Cairo 7 and/or Wardan cultivars, Kronaiki would be the best pollinizer for such cultivars. Kronaiki pollens induced an average of 1.65 g in Cairo 7 cv compared to fruit weight ranging from 1.23-1.4 g in other mating systems and male parents. Same conclusion was true in Wardan cultivar where Kronaiki pollens induced 2.91 g as an average fruit weight compared to the range from 2.08 to 2.56 g for other treatments. Obviously, fruit weight was found to be significantly influenced by mating system and the pollinizer used.

The early findings of Khalil (1978) and Eassa (1993) concluded that cross pollination increased fruit weight compared to selfing and bagging but the current investigation emphasized that the selection of pollinizer has an effective role on fruit weight as Kronaki was an effective male parent even when selfed. This was confirmed by pollen viability test, which indicated higher pollen viability (data not shown). The data of Cairo 7 and Wardan cultivars confirm early findings of Khalil (1978) and Eassa (1993). Therefore, it can be stated that the selection of the male parent (pollinizer) in addition to cross pollination would lead to a heavier fruit weight if the pollinizer had a high pollen viability (as in Kronaiki). Moreover, Cairo 7 proved to produce the least fruit weight when used in almost all crosses followed by Wardan cv. under Assiut and experiment conditions. Controlled pollination by hand vs bagging did not show significant differences in fruit weight.

**Flesh weight (g)**

The effects of different pollination treatments on flesh weight (g) of Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons are presented in Table (2).

**Table 2 Effect of different pollination treatments on flesh weight (g) in Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons.**

| Cultivar / Pollination | | Open | Bagging | Hand selfing | Cross pollination (♂) | | | L.S.D. 0.05 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Cairo 7 | Wardan | Frantoio | |
| Kronaiki | 1996 | 0.48 | 0.62 | 0.60 | 0.26 | 0.34 | 0.45 | 0.04 |
| | 1997 | 0.48 | 0.63 | 0.63 | 0.25 | 0.34 | 0.45 | 0.13 |
| | 1998 | 0.52 | 0.63 | 0.62 | 0.28 | 0.36 | 0.45 | 0.13 |
| | Avg. | 0.49 | 0.63 | 0.62 | 0.26 | 0.35 | 0.45 | |
| | | | | | Kronaiki | Wardan | Frantoio | |
| Cairo 7 | 1996 | 1.05 | 1.06 | 1.08 | 1.31 | 0.95 | 0.93 | 0.06 |
| | 1997 | 1.05 | 1.08 | 1.09 | 1.25 | 0.98 | 0.96 | 0.03 |
| | 1998 | 1.04 | 1.15 | 1.15 | 1.37 | 0.98 | 0.98 | 0.10 |
| | Avg. | 1.05 | 1.10 | 1.11 | 1.31 | 0.97 | 0.96 | |
| | | | | | Kronaiki | Cairo 7 | Frantoio | |
| Wardan | 1996 | 2.08 | 1.78 | 1.79 | 2.26 | 1.63 | 1.72 | 0.08 |
| | 1997 | 2.02 | 1.80 | 1.84 | 2.38 | 1.64 | 1.71 | 0.14 |
| | 1998 | 1.97 | 1.88 | 1.90 | 2.39 | 1.62 | 1.73 | 0.06 |
| | Avg. | 2.02 | 1.82 | 1.84 | 2.34 | 1.63 | 1.72 | |
| | | | | | Kronaiki | Cairo 7* | Wardan | |
| Frantoio | 1996 | 1.18 | 1.52 | 1.61 | 1.30 | - | 1.24 | 0.06 |
| | 1997 | 1.16 | 1.49 | 1.55 | 1.26 | - | 1.22 | 0.06 |
| | 1998 | 1.26 | 1.61 | 1.56 | 1.32 | - | 1.29 | 0.05 |
| | Avg. | 1.20 | 1.54 | 1.57 | 1.29 | - | 1.25 | |

*** No fruit set**

**Kronaiki cultivar** The data presented in Table (2) demonstrated that bagging and selfing pollination gave the heaviest flesh weight compared with the other treatments. On the other hand, cross-pollination with Cairo 7 cultivar resulted in lesser flesh weight (g) comparing with other treatments.

**Cairo 7 cultivar** It is clear from Table (2) that a heaviest flesh weight produced from Cairo 7 fruits when pollinated by Kronaiki olive cultivar. The other pollinating cultivars namely Wardan and Frantoio gave similar the values of flesh weight with no significant differences. Also, the remaining pollination treatments (open pollination, bagging and hand selfing) gave nearly the same values of flesh weight and the differences between them were not significant.

**Wardan cultivar** It could be observed from Table (2) that cross pollination with Kronaiki olive cultivar gave the best results followed by open pollination. Cross-pollination with Cairo 7 cv. gave lowest values of flesh weight (g). On the other hand, bagging and hand selfing pollination gave nearly the same values of flesh weight and the differences between the two treatments were not significant.

**Frantoio cultivar** Bagging and hand selfing gave the best results of flesh weight (Table 2). On the other hand, open pollination gave lowest values of flesh weight compared with other treatments. As mentioned before no fruits were produced from Frantoio cultivar when it was pollinated by Cairo 7 cultivar.

## Flesh weight percentage

The effects of different pollination treatments on flesh weight % of Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons are presented in Table (3).

**Table 3.Effect of different pollination treatments on flesh weight percentage in Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons.**

| Cultivar / Pollination | | Open | Bagging | Hand selfing | Cross pollination (♂) | | | L.S.D. 0.05 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Cairo 7 | Wardan | Frantoio | |
| Kronaiki | 1996 | 68.84 | 67.12 | 67.99 | 67.30 | 65.64 | 69.29 | N.S. |
| | 1997 | 69.18 | 69.05 | 68.50 | 66.22 | 65.37 | 70.39 | 1.80 |
| | 1998 | 68.65 | 67.39 | 68.76 | 65.86 | 65.75 | 67.16 | 1.84 |
| | Avg. | 68.89 | 67.85 | 68.42 | 66.27 | 65.59 | 68.95 | |
| | | | | | Kronaiki | Wardan | Frantoio | |
| Cairo 7 | 1996 | 78.90 | 78.47 | 78.78 | 79.37 | 78.08 | 77.29 | 0.92 |
| | 1997 | 79.16 | 78.89 | 79.17 | 79.28 | 78.88 | 77.28 | N.S. |
| | 1998 | 78.35 | 79.32 | 79.31 | 79.59 | 77.78 | 77.78 | 1.29 |
| | Avg. | 78.80 | 78.89 | 79.09 | 79.41 | 78.25 | 77.45 | |
| | | | | | Kronaiki | Cairo 7 | Frantoio | |
| Wardan | 1996 | 79.21 | 78.79 | 78.82 | 79.66 | 77.71 | 79.26 | N.S. |
| | 1997 | 78.90 | 78.79 | 79.42 | 80.40 | 78.50 | 79.04 | N.S. |
| | 1998 | 78.77 | 78.30 | 79.13 | 81.00 | 77.63 | 78.63 | 1.29 |
| | Avg. | 78.96 | 78.63 | 79.12 | 80.35 | 77.95 | 78.98 | |
| | | | | | Kronaiki | Cairo 7* | Wardan | |
| Frantoio | 1996 | 76.04 | 73.54 | 74.08 | 77.07 | - | 76.42 | 0.32 |
| | 1997 | 77.43 | 74.25 | 74.04 | 77.15 | - | 77.06 | 0.44 |
| | 1998 | 75.60 | 72.90 | 73.07 | 76.01 | - | 75.89 | 0.45 |
| | Avg. | 76.36 | 73.56 | 73.73 | 76.74 | - | 76.46 | |

*** No fruit set**

In all cultivars during the three seasons of study, there were little differences among all pollination treatments in relation to flesh weight percentage. Most differences were not significant particularly in Wardan cv. Mating system was not found to affect flesh weight percentages. Selfing vs. cross-pollination did not show generally significant differences. Some exceptions could be found in Wardan cv. when Kronaiki cv. was used as a pollinizer induced higher flesh weight percentage (80.35) compared to Cairo 7 pollinizer for Wardan (77.95). On the other hand, selfing of Frantoio (bagging and/or hand selfing) induced lower flesh weight % (73.56 and 73.73, respectively) compared to open pollination (76.36) and cross pollination (76.74 and 76.46) with Kronaiki and Wardan pollinizers, respectively. Cairo 7 as a pollinizer for Frantoio did not result in fruit set.

The present data are in agreement with Eassa (1993) who reported insignificant effect of mating system on such character in Manzanillo, Wardan and Frantoio cvs. except in Frantoio cv. where this study showed higher flesh weight % in cross-pollination compared to selfing. Data also are not in agreement with what was mentioned by Khalil (1978) where increment in flesh weight % was reported in Chemlali cv. when was crossed with Hamid cv. In addition, the present data do not agree with what was mentioned by Eassa (1994) who reported decrement in flesh weight % associated with the increment in fruit weight. For instance Wardan when crossed by Kronaiki induced high fruit weight (2-34 g) compared to 1.84 g of hand selfing meanwhile flesh weight % values were 80.35 and 79.12 respectively.

**Fruit Dimensions**

The effect of different pollination treatments on fruit dimensions of Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons are presented in Tables (4, 5, and 6).

**Fruit height (cm)**

**Kronaiki cultivar**

From the obtained data (Table 4), it could be concluded that bagging and hand selfing gave the highest fruit height (cm) compared with other treatments. On the other hand, cross pollination with Cairo 7 cv. gave the shortest fruit among all pollination treatments.

**Table 4. Effect of different pollination treatments on fruit height (cm) in Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons.**

| Cultivar | Pollination | Open | Bagging | Hand selfing | Cross pollination (♂) | | | L.S.D. 0.05 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Cairo 7 | Wardan | Frantoio | |
| Kronaiki | 1996 | 1.53 | 1.78 | 1.72 | 1.31 | 1.38 | 1.49 | 0.17 |
| | 1997 | 1.50 | 1.80 | 1.78 | 1.20 | 1.39 | 1.45 | 0.08 |
| | 1998 | 1.57 | 1.77 | 1.77 | 1.26 | 1.38 | 1.49 | 0.07 |
| | Avg. | 1.53 | 1.78 | 1.76 | 1.26 | 1.38 | 1.48 | |
| | | | | | Kronaiki | Wardan | Frantoio | |
| Cairo 7 | 1996 | 1.85 | 1.88 | 1.88 | 2.06 | 1.82 | 1.78 | 0.10 |
| | 1997 | 1.82 | 1.85 | 1.84 | 1.97 | 1.78 | 1.70 | 0.04 |
| | 1998 | 1.85 | 1.88 | 1.87 | 2.03 | 1.81 | 1.75 | 0.06 |
| | Avg. | 1.84 | 1.87 | 1.86 | 2.02 | 1.80 | 1.74 | |
| | | | | | Kronaiki | Cairo 7 | Frantoio | |
| Wardan | 1996 | 2.10 | 1.97 | 2.00 | 2.23 | 1.95 | 1.92 | 0.10 |
| | 1997 | 2.13 | 2.02 | 1.98 | 2.17 | 1.88 | 1.90 | 0.08 |
| | 1998 | 2.05 | 1.98 | 1.98 | 2.25 | 1.88 | 1.95 | 0.12 |
| | Avg. | 2.09 | 1.99 | 1.99 | 2.22 | 1.90 | 1.92 | |
| | | | | | Kronaiki | Cairo 7* | Wardan | |
| Frantoio | 1996 | 2.09 | 2.59 | 2.63 | 2.30 | - | 2.22 | 0.05 |
| | 1997 | 2.05 | 2.46 | 2.48 | 2.27 | - | 2.26 | 0.12 |
| | 1998 | 2.13 | 2.68 | 2.61 | 2.35 | - | 2.30 | 0.10 |
| | Avg. | 2.09 | 2.58 | 2.57 | 2.31 | - | 2.26 | |

*** No fruit set**

## Cairo 7 cultivar

Data presented in Table (4) showed that the highest fruit height of Cairo 7 cv. occurred when it was pollinated with Kronaiki cv. On the other side, cross pollination with Frantoio cv. gave lowest values of fruit height comparing with other pollination treatments. Slight differences could be observed among the other pollination treatments and differences between most of them were not significant.

## Wardan cultivar

It could be observed from Table (4) that pollination by pollen taken from Kronaiki cv. gave highest values of fruit height (cm). The followed treatment was open pollination. The differences between most other treatments were not significant.

## Frantoio cultivar

Bagging and hand selfing produced the highest fruit height and they had high significant effect compared with the other pollination treatments.

Open pollination gave lowest values of fruit height. On the other hand, little differences could be observed on fruit height of Frantoio cv. when it was pollinated by Kronaiki and Wardan cv.

**Fruit diameter**

**Kronaiki cultivar**

Data presented in Table (5) indicated that the highest values of fruit diameter were produced by bagging and selfing . The lowest values were found when Kronaiki was pollinated by Cairo 7 cv.

**Table 5. Effect of different pollination treatments on fruit diameter (cm) in Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons.**

| Cultivar \ Pollination | | Open | Bagging | Hand selfing | Cross pollination (♂) | | | L.S.D. 0.05 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Cairo 7 | Wardan | Frantoio | |
| Kronaiki | 1996 | 0.89 | 0.99 | 0.97 | 0.75 | 0.81 | 0.89 | 0.04 |
| | 1997 | 0.89 | 0.99 | 0.99 | 0.72 | 0.81 | 0.89 | 0.04 |
| | 1998 | 0.93 | 1.00 | 0.98 | 0.76 | 0.80 | 0.88 | 0.04 |
| | Avg. | 0.90 | 0.99 | 0.98 | 0.74 | 0.81 | 0.89 | |
| | | | | | Kronaiki | Wardan | Frantoio | |
| Cairo 7 | 1996 | 1.12 | 1.13 | 1.13 | 1.18 | 1.12 | 1.10 | 0.05 |
| | 1997 | 1.15 | 1.17 | 1.15 | 1.20 | 1.13 | 1.10 | 0.05 |
| | 1998 | 1.15 | 1.16 | 1.15 | 1.20 | 1.14 | 1.11 | 0.03 |
| | Avg. | 1.14 | 1.15 | 1.15 | 1.19 | 1.13 | 1.10 | |
| | | | | | Kronaiki | Cairo 7 | Frantoio | |
| Wardan | 1996 | 1.48 | 1.42 | 1.40 | 1.53 | 1.38 | 1.37 | 0.07 |
| | 1997 | 1.53 | 1.43 | 1.40 | 1.57 | 1.35 | 1.42 | 0.04 |
| | 1998 | 1.52 | 1.47 | 1.43 | 1.58 | 1.35 | 1.40 | 0.04 |
| | Avg. | 1.51 | 1.44 | 1.41 | 1.56 | 1.36 | 1.40 | |
| | | | | | Kronaiki | Cairo 7* | Wardan | |
| Frantoio | 1996 | 1.35 | 1.76 | 1.82 | 1.43 | - | 1.39 | 0.05 |
| | 1997 | 1.32 | 1.64 | 1.68 | 1.42 | - | 1.41 | 0.06 |
| | 1998 | 1.39 | 1.76 | 1.74 | 1.46 | - | 1.44 | 0.08 |
| | Avg. | 1.35 | 1.72 | 1.75 | 1.44 | - | 1.41 | |

*** No fruit set**

**Cairo 7 cultivar**

From tabulated data (Table 5) , cross pollination with Kronaiki cv. gave the highest values of fruit diameter compared with the other treatments. Little differences could be observed among remaining pollination treatments and differences between most of them were not significant.

**Wardan cultivar**

Data obtained in Table (5) indicated that cross-pollination with Kronaiki gave highest values of fruit diameter followed by open pollination. The lowest values of fruit diameter were observed when cross pollination by Cairo 7 except in 1996. The other treatments gave similar values and the differences between most of them were not significant.

**Frantoio cultivar**

It is clear from Table (5) that selfing and bagging gave highest fruit diameter and open pollination gave lowest values. The differences between cross pollination by Kronaiki and Wardan were not significant.

**Fruit index (height/diameter ratio)**

Data presented in Table (6) showed the effect of different pollination treatments on the ratio of height/diameter.

**Table 6. Effect of different pollination treatments on fruit index (height/ diameter) in Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons.**

| Cultivar \ Pollination | | Open | Bagging | Hand selfing | Cross pollination (♂) | | | L.S.D. 0.05 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Cairo 7 | Wardan | Frantoio | |
| Kronaiki | 1996 | 1.72 | 1.80 | 1.78 | 1.74 | 1.71 | 1.69 | N.S. |
| | 1997 | 1.69 | 1.83 | 1.80 | 1.68 | 1.72 | 1.63 | 0.12 |
| | 1998 | 1.70 | 1.77 | 1.83 | 1.66 | 1.73 | 1.71 | N.S. |
| | Avg. | 1.70 | 1.77 | 1.80 | 1.69 | 1.72 | 1.68 | |
| | | | | | Kronaiki | Wardan | Frantoio | |
| Cairo 7 | 1996 | 1.66 | 1.67 | 1.66 | 1.75 | 1.63 | 1.62 | N.S. |
| | 1997 | 1.58 | 1.59 | 1.60 | 1.64 | 1.58 | 1.55 | N.S. |
| | 1998 | 1.61 | 1.62 | 1.62 | 1.68 | 1.59 | 1.57 | 0.06 |
| | Avg. | 1.62 | 1.63 | 1.63 | 1.69 | 1.60 | 1.58 | |
| | | | | | Kronaiki | Cairo 7 | Frantoio | |
| Wardan | 1996 | 1.42 | 1.39 | 1.43 | 1.46 | 1.41 | 1.40 | N.S. |
| | 1997 | 1.39 | 1.42 | 1.42 | 1.39 | 1.39 | 1.34 | N.S. |
| | 1998 | 1.35 | 1.35 | 1.38 | 1.42 | 1.39 | 1.39 | N.S. |
| | Avg. | 1.39 | 1.39 | 1.41 | 1.42 | 1.40 | 1.38 | |
| | | | | | Kronaiki | Cairo 7* | Wardan | |
| Frantoio | 1996 | 1.55 | 1.47 | 1.45 | 1.60 | - | 1.60 | 0.05 |
| | 1997 | 1.56 | 1.50 | 1.58 | 1.60 | - | 1.60 | 0.07 |
| | 1998 | 1.53 | 1.52 | 1.50 | 1.61 | - | 1.60 | 0.06 |
| | Avg. | 1.55 | 1.50 | 1.48 | 1.60 | - | 1.60 | |

*** No fruit set**

**Kronaiki cultivar**

From the obtained data it could be observed that at 1996 and 1998 there were no significant effect of different pollination treatments on the fruit index while in 1997, bagging and selfing gave highest ratios.

**Cairo 7 cultivar**

The differences between all pollination treatments at 1996 and 1997 were not significant. While at 1998 season the significant difference was only between cross pollination with Kronaiki and the other treatments.

**Wardan cultivar**

There were no significant effect of pollination treatments on fruit index during the three seasons of study.

**Frantoio cultivar**

Data presented in Table (6) demonstrated that cross pollination with Kronaiki and Wardan gave the highest ratio. Little differences could be observed between the other treatments .

In conclusion, data presented in the current study indicated that Kronaiki pollens induced the highest fruit height even when selfed also as a pollinizer for Cairo 7 and Wardan cultivars. Frantoio cultivar had also a positive effect on fruit height but only in selfing while as a pollinizer of other cultivars did not have a promotive effect in this character. Data also showed that Kronaiki followed by Frantoio showed strong effect on such character in selfing and their combination when they were used as pollinizer. Cross-pollination did not show superiority against selfing in such character. Same conclusion also applied to fruit diameter. Fruit shape of Frantoio cv. was found to be significantly influenced by mating system, selfing of Frantoio produced fruits with less height/diameter ratio than cross and open pollination. Such observation was not observed in other cultivars.

The early studies by Khalil (1978) and Eassa (1993) supported the present study concerning varietal responses to specific mating systems and pollinizer. In addition, no particular trend was found to all cultivars in the these characters (height, diameter and fruit index). Fruit shape of their studies showed slight-insignificant effect of pollinizer and mating system in Chemlali, Mission, Manzanillo, Frantoio and Wardan cvs. combinations. The later was not in agreement of the data of the current study where cross and open pollination induced longer fruit in Frantoio while the opposite was found in Kronaiki , where selfing induced longer fruit compared to crossing.

Fouad *et al* (1992) confirmed the relation between olive fruit dimensions and olive cultivars. Fruit dimensions increased gradually from the beginning of fruit development till fruits reached their full size (Ezzat and El-Azzouni 1963, Hegazi 1970 and Hassan 1980).

## Seed weight

The effect of different pollination treatments on seed weight of the olive cultivars during the 3 seasons are presented in Table (7).

**Table 7. Effect of different pollination treatments on seed weight (g) in Kronaiki, Cairo 7, Wardan and Frantoio olive cultivars during 1996, 1997 and 1998 seasons.**

| Cultivar | Pollination | Open | Bagging | Hand selfing | Cross pollination (♂) | | | L.S.D. 0.05 |
|---|---|---|---|---|---|---|---|---|
| | | | | | Cairo 7 | Wardan | Frantoio | |
| Kronaiki | 1996 | 0.22 | 0.30 | 0.28 | 0.11 | 0.18 | 0.20 | 0.03 |
| | 1997 | 0.21 | 0.28 | 0.29 | 0.13 | 0.18 | 0.19 | 0.02 |
| | 1998 | 0.24 | 0.31 | 0.28 | 0.15 | 0.19 | 0.22 | 0.02 |
| | Avg. | 0.22 | 0.30 | 0.28 | 0.13 | 0.18 | 0.20 | |
| | | | | | Kronaiki | Wardan | Frantoio | |
| Cairo 7 | 1996 | 0.28 | 0.29 | 0.29 | 0.34 | 0.27 | 0.27 | 0.02 |
| | 1997 | 0.28 | 0.29 | 0.29 | 0.33 | 0.26 | 0.28 | 0.03 |
| | 1998 | 0.29 | 0.30 | 0.30 | 0.35 | 0.28 | 0.28 | 0.03 |
| | Avg. | 0.28 | 0.29 | 0.29 | 0.34 | 0.27 | 0.28 | |
| | | | | | Kronaiki | Cairo 7 | Frantoio | |
| Wardan | 1996 | 0.55 | 0.48 | 0.48 | 0.59 | 0.47 | 0.45 | 0.11 |
| | 1997 | 0.54 | 0.49 | 0.48 | 0.58 | 0.45 | 0.46 | 0.06 |
| | 1998 | 0.53 | 0.52 | 0.50 | 0.56 | 0.46 | 0.47 | 0.04 |
| | Avg. | 0.54 | 0.50 | 0.49 | 0.58 | 0.46 | 0.46 | |
| | | | | | Kronaiki | Cairo 7* | Wardan | |
| Frantoio | 1996 | 0.37 | 0.55 | 0.56 | 0.39 | - | 0.38 | 0.03 |
| | 1997 | 0.34 | 0.52 | 0.54 | 0.37 | - | 0.36 | 0.02 |
| | 1998 | 0.41 | 0.60 | 0.58 | 0.42 | - | 0.41 | 0.02 |
| | Avg. | 0.37 | 0.56 | 0.56 | 0.39 | - | 0.38 | |

*** No fruit set**

## Kronaiki cultivar

It is clear from Table (7) that smallest seeds were obtained when Kronaiki cultivar was pollinated by Cairo 7 cultivar. On the other hand, heaviest seed weight was observed upon bagging and hand selfing .

## Cairo 7 cultivar:

Differences among the various pollination treatments on the seed weight (with exception of cross pollination with Kronaiki) were not

significant. Cross-pollination with Kronaiki gave heaviest seed weight compared with other pollination treatments.

**Wardan cultivar**

Data presented in Table (7) showed that cross pollination with Kronaiki gave the heaviest seed weight followed by open pollination.

**Frantoio cultivar**

Open pollination and cross pollination with Kroaniki and Wardan cvs. gave less seed weight and the differences between them were not significant. On the other hand, bagging and hand selfing gave heavier seed weight and also the differences between them were not significant.

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## دراسات على التزهير والعقد لبعض أصناف الزيتون تحت ظروف أسيوط البيئية

## ب – تأثير التلقيح على الصفات الطبيعية للثمار

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أجريت هذه الدراسة خلال ثلاثة مواسم زراعية متتالية ( ١٩٩٦ ، ١٩٩٧ ، ١٩٩٨) على أربعة أصناف من الزيتون هى كروناكى ، قاهره ٧ ، فرانتويو وهى أصناف زيت وصنف وردان وهو صنف مزدوج الغرض ( تخليل ، زيت ) منزرعة ببستان كلية الزراعة جامعة أسيوط .وكانت أهداف البحث هى دراسة علاقة نوع التلقيح وتأثير الاباء على خصائص الثمار الطبيعية مثل وزن الثمرة، وزن البذرة ، وزن اللحم ونسبتة المئوية .

كان جمع حبوب اللقاح من على الأشجار يتم بواسطة تعليم بعض الأفرع ووضع هذه الأفرع فى أكياس من الورق وتركها على الأشجار حتى بداية تفتح الأزهار وتم أخذ حبوب اللقاح لاستخدامها فى عمليات التلقيح . أجريت عمليات التهجين بعد اجراء عمليات الخصى لأزهار الصنف المراد تلقيحه.

وكانت أهم النتائج المتحصل عليها كالتالى :

كان أكبر وزن للثمار فى الصنف وردان عند تلقيحه بالصنف كروناكى وكانت أقلها فى الصنف كروناكى عند تلقيحه بصنف قاهره ٧ .

وجـد أن أكبر وزن للحم الثمرة فى الصنف وردان عند تلقيحه بصنف كروناكى وأقلها فى الصنف كروناكى عند تلقيحه بملقح قاهره ٧ .

زادت النسـبة المـئوية لـوزن اللحم فى الثمرة فى الصنف وردان عند تلقيحه بالصنف كروناكى وأنخفضت فى الصنف كروناكى عند تلقيحه بالصنف قاهره ٧ .

أرتفـاع وقطـر الثمرة كان أكبر فى التلقيح الذاتى لصنف فرانتويو وانخفض فى الصنف كروناكى عند تلقيحه بملقح قاهره ٧ .

أدت معاملة التلقيح الذاتى للصنف فرانتويو الى زيادة وزن البذرة بينما فى الصنف كروناكى فأدت معاملة تلقيحه بملقح قاهره ٧ الى خفض وزن البذرة .

ينصح تحت ظروف هذه التجربة باستخدام الصنف كروناكى كملقح جيد لأصناف الزيتون وردان ، فرانـتويو وقاهـره ٧ حيث أنه يحسن من صفات الثمار الطبيعية .كذلك لا ينصح بزراعة صنف الزيـتون قاهرة ٧ تحت ظروف أسيوط من إرتفاع في درجة الحرارة و الجفاف حيث تتأثر حبوب لقـاح هذا الصنف بهذه الظروف مما يؤدي إلي إنخفاض عقد الثمار سواء داخل الصنف أو عند استخدامه كملقح لأصناف أخري