Effect of Pollen Source on Yield, Quality and Maturity of 'Mejhool' Date Palm

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ABSTRACT

To study the effects of pollens on yield, maturity and fruit quality of "Mejhool" date palm cultivar, several local and commercial male trees were used. High fruit set was obtained when spathes were pollinated with "Aqaba" and "Dayyat1" on the 2003 season and with "Jarvis", "Aqaba", "Boyer" and "Barakah" on the 2004 season. Also, spathes pollinated with "Aqaba" pollen on the 2003 season and with "Dayyat1" and "Mejhool" on the 2004 season gave the highest fruit weight, while those pollinated with "Boyer" (2003 season) and "Jarvis" (2004 season) pollen gave the least fruit weight. In addition, spathes pollinated with "Aqaba" increased fruit maturity while those pollinated with "Barakah" male delayed it. The highest fruit flesh weight was when spathes were pollinated with "Barakah", "Jarvis" and "Dayyat1", while those pollinated with and "Mejhool" gave the least flesh weight.

KEYWORDS: *Phoenix dactylifera* L., pollen, mejhool, pollination, fruit quality.

1. INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is a very important fruit trees throughout the world as well as in Jordan in which date palm plantations had increased in the last years exceeded 8000 dunums, mostly at the Jordan Valley (Ministry of Agriculture Statistics, 2003). However, this has not coincided with the increase in the knowledge of the appropriate cultural practices, among these the pollination process and related practices. In addition, little information is available about date palm males which could mean the use of low quality males (low pollen viability) in pollinating high valuable female trees which will affect fruit set and thus yield and quality.

Date palm is a dioecious plant with separate male and female trees in which pollination is normally done by wind, however, to ensure and improve fruit setting, pollination is done artificially in which mature male inflorescence are cut off before spathe splits, and strands are placed in the female flower cluster so pollens will be transferred onto female flowers (Asif *et al.*, 1983; Shabana *et al.*, 1985). Pollen of date palm has an effect on the resulting seed shape and size (Xenia) and on the size, development, quality and ripening time of date palm fruits (Metaxenia) (Nixon, 1956). Several methods were used to determine pollen viability including staining and enzymes but germinating pollen in nutrient media was considered the most efficient and accurate method (Albert, 1930 and Stanley *et al.*, 1974). Also, several

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sucrose concentrations were tested in nutrient media preparation but 20% was found to be the best (Shafaat *et al.*, 1978 and Shabana *et al.*, 1985). In addition, male trees differed in pollen tube germination test which means differences in their viability (Shabana *et al.*, 1985). Pollen source affect ripening time and those produced smaller fruits and seeds, also produced earlier ripening (Monselise, 1988 and Nixon, 1956). Pollen from "Ghannami" and "Werdi" shortened the Khalal stage of "Zehdi" and increased the matured fruit percentage, while "Rissasi" and "Werdi" pollen increased fruit set. In addition, fruits pollinated with "Werdi" had the lowest seed weight; however, fruits pollinated with "Ghannami" had the highest soluble solids percentage (Delaimy, 1969).

This research aimed to study the effect of different sources of pollen (male trees) on fruit quality and maturity of "Mejhool" date palm cultivar.

2. MATERIALS AND METHODS

This study was conducted at Sameer Kawar Farm at Damia in the Jordan Valley for the 2003 and 2004 seasons. Several local date palm seedling males were evaluated in respect to their viability (according to germination test in a nutrient media), the following were selected and named according to their location in Jordan: "Dayyat 1", "Dayyat 2" from Dayyat Agricultural Station at Deir Alla, "Aqaba" from Arab Palm Plantation and "Barakah" from Al-Barakah Farm at Al-Karamah. In addition, three commercial males were used in this study: "Jarvis" and "Boyer" males from Al-Barakah Farm and "Mejhool" from Sameer Kawar Farm.

At the beginning of each season, pollen germination test was done in a nutrient media which consisted of 20 % sucrose and 1 % agar according to the method followed by Kwan (1969) and Asif *et al.* (1983). Pollen germination was recorded after 24 hour under microscope 100x and for those had germination tube longer than pollen diameter, results were statistically analyzed according to Randomized Complete Block Design (RCBD) with three replicates.

Four 8 year-old uniform "Mejhool" trees were selected as separate replicates. All spathes on female trees were covered with paper bags before opening. At the natural opening of female spathe, each one was pollinated with one source of pollen and covered with paper bags to prevent contamination with other sources. These bags were removed after two weeks of pollination. Pollens were diluted by mixing with flour at a ratio of 1 pollen : 2 flour to insure maximum pollen distribution.

Six pollen sources (males) were used in the first season while seven sources were used in the second season due to their availability. Bunches were thinned 45 days after pollination, 40 spikelets were left on each bunch each contains 8 fruits.

The following parameters were recorded: fruit set %, fruit weight, length, and diameter, seed weight, Total Soluble Solids (TSS%), maturity % (calculated as weight of fruit reach Rutab stage to the total fruit weight), and flesh %.

Collected data were statistically analyzed by ANOVA according to Randomized Complete Block design with three replicates, and mean separation was calculated according to the Least Significant Differences (LSD) method at the 5% level of significance.

3. RESULTS AND DISCUSSION

3.1. Pollen Germination Test

Pollen germination percentage of the first season 2003 ranged from 33.1 % for "Jarvis" to 83.6 % for "Dayyat 1"

which gave with "Dayyat 2" the highest % pollen germination. For the 2004 season, it ranged from 63.7 % for "Mejhool" to 88.7 % for "Dayyat1" which significantly gave the highest % pollen germination (Table 1).

Table (1): Pollen germination% for seven males used in the experiment.

Treatment	Pollen germ. %	
	2003	2004
Jarvis	33.1 e	65.5 bc
Mejhool	71.9 b	63.7 c
Aqaba	57.8 c	72.4 bc
Dayyat 1	83.6 a	88.7 a
Boyer	41.7 d	67.7 bc
Barakah	35.0 de	68.7 bc
Dayyat 2	82.6 a	75.2 b

* Figures followed by the same litter in each column are not significantly different at 5% probability.

The low pollen germination percentage in the first season could be due to the low temperatures and high relative humidity during the flowering period of the 2003 season compared with the same period of the 2004 season. Such differences may affect pollen growth and development and thus its germination (Furr *et al.*, 1970 and Reuveni *et al.*, 1985) (Figures 1, 2).

3.2. Fruit Set Percentage

Results of the 2003 season indicated that the highest fruit set was obtained when spathes were pollinated with "Aqaba" and "Dayyat 1" pollen (80.4 and 79.5 %, respectively) but with no significant differences with other treatments except those pollinated with "Barakah" which gave the least fruit set (62.8 %) (Table 2).

However, the 2004 season results showed some controversy; spathes pollinated with "Jarvis", "Aqaba", "Boyer" and "Barakah" pollen gave the highest fruit set % but with no significant differences with other treatments except those pollinated with "Mejhool" which gave the least fruit set (55.8%) (Table 2).

3.3. Fruit Weight

For the 2003 season, the highest fruit weight was obtained when spathes were pollinated with "Aqaba" although it gave for the two seasons a high fruit set. This may be reasonable due to thinning treatments applied to fruit bunches which will minimize the effect of high fruit set. However, trees pollinated with "Boyer" significantly gave the least fruit weight (Table 2).

Results of the 2004 season showed –in general- a higher fruit weight in comparison with the 2003 season; spathes pollinated with "Dayyat 1" and "Mejhool" gave the highest fruit weight, while those pollinated with "Jarvis" significantly gave the least fruit weight although it gave a high fruit weight in the 2003 season (Table 2).

Table (2): Effect of pollens on fruit set percentage and average fruit weight (gm) of Mejhool variety.

Treatment	Fruit set%		Av. Fruit wt (gm)	
	2003	2004	2003	2004
Jarvis	69.0 ab	74.6 a	34.2 abc	30.7 c
Mejhool	67.3 ab	55.8 b	35.4 ab	36.5 a
Aqaba	80.4 a	70.1 a	37.2 a	35.1 ab
Dayyat 1	79.5 a	68.5 ab	33.2 bcd	37.0 a
Boyer	70.7 ab	71.6 a	30.7 d	34.2 abc
Barakah	62.8 b	69.0 a	32.0 cd	32.4 bc
Dayyat 2	---	64.6 ab	---	32.4 bc

* Figures with the same litter in each column are not significantly different at 5% probability.

3.4. Fruit Length and Diameter

Results of the 2003 and 2004 seasons showed that the highest fruit length was obtained when spathes were

pollinated with "Mejhool" pollen, however, spathes pollinated with "Boyer" in the 2003 season and with "Jarvis" and "Barakah" pollen in the 2004 season gave the least fruit length (Table 3).

Results of the 2003 season showed that the highest fruit diameter was obtained when spathes were pollinated with "Aqaba" pollen but with no significant differences with those pollinated with "Mejhool" and "Jarvis", while those pollinated with "Barakah" and "Boyer" significantly gave the least fruit diameter. For the 2004 season, no significant differences were observed among treatments (Table 3).

Fruit shape results during the 2004 season showed that the different pollen affected fruit shapes to some extent; spathes pollinated with "Boyer" and "Dayyat1" gave the highest L/D ratio, however, the least ratio was observed when spathes were pollinated with "Jarvis" (Table 3).

3.5. Seed Weight

Results of the 2004 season were obtained; seed weight of fruits originally pollinated with "Aqaba" and "Boyer" pollen gave the largest seed weight, however, those pollinated with "Jarvis" male gave the smallest seeds (table 4).

3.6. Maturity Percentage

Maturity results of the 2003 season revealed that "Mejhool" spathes pollinated with "Aqaba" male increased fruit maturity but with no significant differences with other treatments except for those pollinated with "Barakah" male which delayed fruit maturity (table 4). These results could have an importance with respect to controlling fruit maturity depending on the market situation especially when high demands or prices are expected in the local or external markets.

3.7. Flesh Percentage

Results of the 2003 season showed that the fruit flesh was high when spathes were pollinated with "Barakah", "Jarvis" and "Dayyat 1" males but with no significant differences with those pollinated with "Boyer", while those pollinated with "Mejhool" and "Aqaba" gave the least fruit flesh % (Table 4).

Results of the 2004 season showed some similarity with the 2003 season; "Dayyat 1" and "Jarvis" males gave the highest fruit flesh % but with no significant differences with those pollinated with "Barakah" and "Dayyat 2". Also, spathes pollinated with "Boyer" and "Aqaba" significantly gave the least fruit flesh % (table 4). These results indicated that pollinating "Mejhool" trees with "Jarvis", "Dayyat 1" and "Barakah" will produce highly fleshed fruits with smaller seeds. Such fruit characteristics are appreciated by the consumers.

3.8. Total Soluble Solids (TSS %)

Results indicated that pollen source has little or no effect on fruit total soluble solids. However, spathes pollinated with "Barakah" in the first season and with "Aqaba" in the second season gave the highest total soluble solids %. Meanwhile, spathes pollinated with "Jarvis" pollen in both seasons gave the least total soluble solids % (Table 4).

Table (3): Effect of pollens on fruit set percentage fruit length and diameter (mm) and L/D ratio of Mejhool variety.

Treatment	Av. Fruit length (mm)		Av. Fruit Diameter (mm)		Length/Diameter	
	2003	2004	2003	2004	2003	2004
Jarvis	49.3 ab	49.1 c	35.8 ab	35.1 a	1.4 a	1.40 c
Mejhool	51.7 a	54.0 a	35.8 ab	36.1 a	1.4 a	1.48 ab
Aqaba	51.1 ab	51.2 bc	36.5 a	36.1 a	1.4 a	1.43 bc
Dayyat 1	48.7 b	52.5 ab	35.0 bc	35.6 a	1.4 a	1.48 ab
Boyer	49.0 ab	53.2 ab	33.7 c	35.6 a	1.5 a	1.50 a
Barakah	49.3 ab	49.3 c	34.4 c	35.3 a	1.4 a	1.43 bc
Dayyat 2	---	51.2 bc	---	35.1 a	---	1.50 a

* Figures with the same litter in each column are not significantly different at 5% probability.

Table (4): Effect of pollens on seed weight, fruit maturity %, fruit flesh %, and total soluble solids (TSS %) of Mejhool variety.

Treatment	Seed wt. (gm)	Maturity %	Flesh %		TSS %	
	2004	2003	2003	2004	2003	2004
Jarvis	1.5 d	22.4 ab	95.2 a	95.0 a	31.3 a	38.0 a
Medjool	1.9 ab	22.6 ab	94.5 c	95.7 ab	32.2 a	42.6 a
Aqaba	2.0 a	36.4 a	94.6 bc	94.3 b	37.2 a	43.8 a
Dayyat 1	1.8 bc	28.9 ab	95.2 a	95.2 a	36.0 a	42.6 a
Boyer	2.0 a	12.9 ab	95.1 ab	94.2 b	33.8 a	39.5 a
Barakah	1.7 cd	3.1 b	95.6 a	94.8 ab	39.3 a	40.3 a
Dayyat 2	1.9 ab	---	---	94.5 ab	---	41.4 a

* Figures with the same litter in each column are not significantly different at 5% probability.

According to several researchers, seedling males used for pollination are highly variable; they varied considerably with respect to vegetative and reproductive characters including pollen quality and viability and compatibility, i.e. males differ in their response according to the female tree pollinated (El-Sabrout, 1979; Nasr *et al.*, 1986; Al-Ghamdi *et al.*, 1988 and Shaheen, 2004). So it is important to use high quality date palm male (high pollen viability) in pollinating high valuable female trees. These findings are in general agreement with the results of this study since the males tested varied in their viability.

With respect to fruit setting, male palms tested in this study varied in their effect in fruit set which was supported by the work of El-Ghayaty (1982) and Bacha *et al.* (1988) who found that the type of pollen used affected

the percentage of fruit setting as well as the fruit properties with various degrees and such effect varied depending on the females' cultivars used.

The results of this study revealed that male palms tested varied in their effect in fruit quality and maturity, i.e. some males hastened maturity while others delayed it, which was confirmed by the work of Ahmed and Ali (1960), Delaimy (1969) Desoukey *et al.* (1993); Hussein (1979) and Nixon (1956) who noticed that pollen have a direct influence on fruit physical and chemical characteristics so called the metaxenic effect; pollen influence fruit set percent, fruit shape, size, color, in addition to, seed shape and size, fruit quality, ripening and soluble solids. These findings are in general agreement with our results except for total soluble solids.

Al-Ghamdi *et al.* (2002) concluded that there are without doubt, vast possibilities for the improvement of date culture throughout the world through the utilization of metaxenia, under some conditions such as later ripening may be desirable, and it might be possible to find male palms whose pollen would produce it.

Finally, the results of "Mejhool" pollination revealed that there was no relationship between fruit set and weight which could be due to the excessive fruit thinning done for this variety to have high quality fruits which would diminish or reduce the importance of having high fruit set percentage.

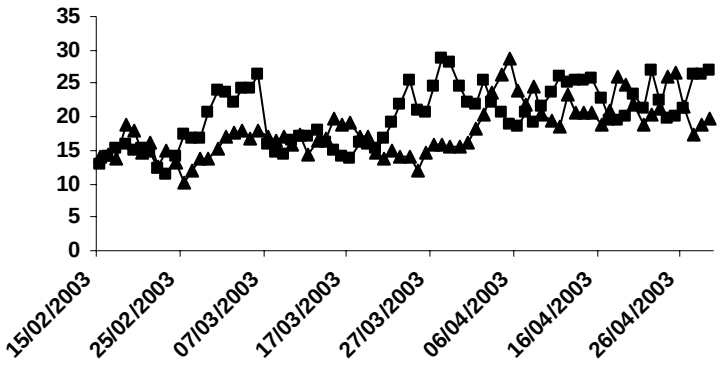

Figure (1): Mean daily temperature during flowering period

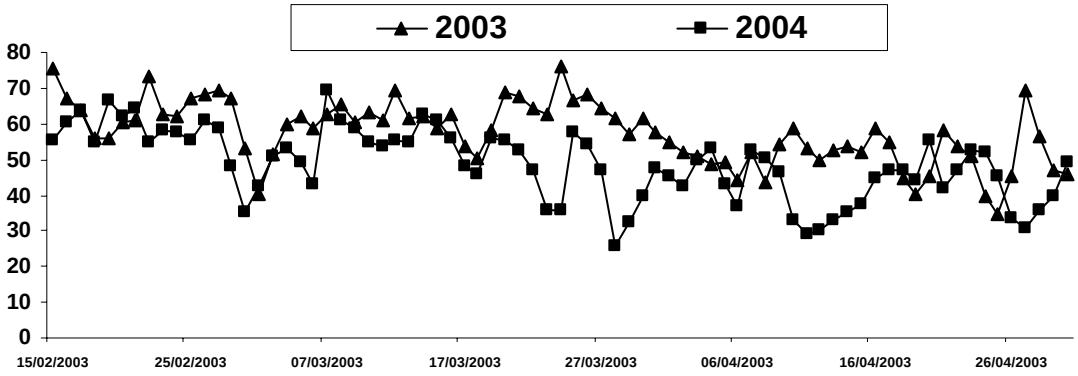

Figure (2): Mean daily relative humidity during flowering period.

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تأثير حبوب اللقـاح على إنتاجية، ونوعية، وموعد نضج ثمار نخيل البلـح من الصنف "مجهـول"

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ملخـص

لدراسة تأثير مصدر حبوب اللقاح على إنتاج، وموعد نضج، ونوعية ثمار نخيل البلح، تم استعمال حبوب لقاح من مصادر مختلفة بعضها محلي وبعضها الآخر تجاري عالمي لموسمي 2003 و2004م في تلقيح أشجار متجانسة من الصنف "مجهول".

دلت النتائج على وجود تأثير واضح لحبوب اللقاح في الصفات المختلفة للثمار، فالتلقيح بحبوب لقاح من الأشجار المذكرة "عقبة" و"ديات1" للموسم الأول ومن "جارفس"، "عقبة"، "بوبير"، و"بركة" للموسم الثاني أعطى أعلى نسبة عقد للثمار. كما ان التلقيح بحبوب لقاح من الأشجار المذكرة "عقبة" للموسم الأول و"ديات1" و"مجهول" للموسم الثاني أعطى أعلى وزن للثمار، في حين ان اقل وزن للثمار كان عند التلقيح بحبوب لقاح "بوبير" في الموسم الأول و"جارفس" في الموسم الثاني. بالإضافة إلى ذلك، فان التلقيح بحبوب لقاح "عقبة" بكّر في نضج الثمار في حين ان التلقيح بحبوب لقاح "بركة" أخّر نضجها. كما أثرت حبوب اللقاح في نسبة المادة اللحمية، فالتلقيح بحبوب لقاح الذكور "بركة"، "جارفس"، و"ديات1" أعطى اكبر مادة لحمية، واقلها كان عند التلقيح بحبوب لقاح "مجهول".

الكلمات الدالة: *Phoenix dactylifera* L.، حبوب لقاح، مجهول، تلقيح، نوعية الثمار.

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