

Effect of Pollen Source on Yield, Quality and Maturity of “Barhi” Date Palm

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ABSTRACT

To study the effects of pollen grain source on yield, maturity and fruit quality of “Barhi” date palm cultivar, three local and three commercial male trees were used in the 2002 season. Results indicated that pollinating trees with “Aqaba” male gave the least fruit set while those pollinated with “Boyer” and “Dayyat1” gave the highest set. In addition, the highest fruit weight recorded when trees were pollinated with “Mejhool” and “Aqaba” males; however, the least weight was with those pollinated with “Boyer”. The highest flesh weight % was for trees pollinated with “Aqaba” and “Barakah” while those pollinated with “Boyer” gave the least flesh %. Also, pollinating trees with “Barakah” hastened maturity of “Barhi” while pollinating trees with “Aqaba” delayed it. However, no effect was observed of pollen source on productivity of “Barhi” date palm.

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

1. INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is a very important fruit tree throughout the world as well as in Jordan in which date palm plantations had increased in the last years. The land planted with date palm exceeded 8000 dunums mostly in the Jordan Valley (Ministry of Agriculture Statistics, 2003). However, this did not coincide with the increase in the knowledge of the appropriate cultural practices of date palm such as the pollination process. 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 fruit 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 is cut off, and strands are placed in the female flower cluster so pollen will be transferred onto female flowers (Asif *et al.*, 1983; Asif *et al.*, 1987; 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, 1955). Several methods were used to determine pollen viability including staining and enzymes but germinating pollens in nutrient media was considered the most efficient and accurate method (Albert, 1930 and Stanley, *et al.*, 1974). Also, several 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

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differences in their viability (Shabana, *et al.*, 1985). Pollen source effects ripening time and those which produced smaller fruits and seeds, also they produced earlier ripening (Monselise, 1988 and Nixon, 1956). Pollen from both “Ghannami” and “Werdi” males shortened the Khalal stage of “Zehdi” and increased matured fruit percentage, however, pollen from “Rissasi” and “Werdi” resulted in high fruit set, while those pollinated with “Werdi” had the lowest seed weight %, however, “Ghannami” male gave the highest fruit soluble solids percentage (Delaimy, 1969).

This research aimed to study the effect of different sources of pollen (male trees) on the yield, quality, and maturity of “Barhi” date palm cultivar.

2. MATERIALS AND METHODS

This study was conducted at Al-Barakah Farm at Al-Karamah area in the Jordan Valley on eighteen 12 year old uniform ‘Barhi’ trees divided into three replicates during the 2002 season. Several local date palm seedling males were evaluated with respect to their viability (according to germination test), the following were selected and named according to their location in Jordan and to ease the handling of such males: “Dayyat 1” from Dayyat Agricultural Station at Deir Alla, “Aqaba” from Arab Palm Plantation and “Barakah” from Al-Barakah Farm. 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 the season, pollen germination test was done for all pollen sources 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 hours under microscope 100x and for those which had germination tube longer than pollen diameter, results were statistically analyzed according to Randomized Complete Block Design (RCBD) with three replicates.

At the natural opening of female spathe, each tree was pollinated with one source of pollen and spathe was

covered with paper bag to prevent contamination with other sources. These bags were removed after two weeks of pollination. Pollen were diluted by mixing them with flour in a ratio of 1 pollen : 2 flour to ensure maximum pollen use.

Eight female spathe were left per tree to ensure uniformity, fruit set % was calculated four weeks after pollination. At the end of the season, the following parameters were recorded: Total yield, fruit weight, length, and diameter, seed weight, length and diameter, Total Soluble Solids (TSS%), maturity % (calculated as weight of fruit reach Rutab stage to the total fruit weight at harvesting date), bunch weight, and fruit flesh weight %.

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

I- Pollen Germination Test:

Pollen germination % ranged from 60.7 % for “Mejhool” to 89.3 % for “Dayyat 1” which significantly gave the highest % of pollen germination (table1). Despite the differences, these results in general were considered good and gave an indication for high pollen viability.

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

Treatment (Male)	Pollen Germination %
Boyer	c 76.6
Barakah	73.8 cd
Jarvis	70.6 d
Mejhool	60.7 e
Aqaba	83.4 b
Dayyat1	89.3 a

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

II- Fruit Quality:**1-Fruit set:**

Fruit set results indicated that trees pollinated with “Boyer” and “Dayyat 1” gave the highest fruit set (72.5 and 70.3 %, respectively) but with no significant differences with other treatments except for those pollinated with “Aqaba” which gave the least fruit set (55.9 %) (Table 2).

2- Yield:

No significant differences among treatments were observed, however, trees pollinated with “Boyer” and “Dayyat 1” gave the highest yield (134.7 and 132.3 kg, respectively) while those pollinated with “Aqaba” gave the least yield (109.0 kg) (Table 2). The same was observed for average bunch weight (kg).

3- Fruit Weight:

“Barhi” trees pollinated with “Aqaba” and “Mejhool” males gave the highest fruit weight (11.3 and 10.5 gm, respectively) but with no significant differences with other treatments except for those pollinated with “Boyer” which gave the least fruit weight (8.4 gm), and this demonstrates the high relationship between fruit set % and fruit weight (Table 3).

4- Fruit Length and Diameter:

No significant differences among treatments were observed with respect to fruit length. As in fruit weight, the highest fruit diameter obtained for trees pollinated with “Aqaba” but with no significant differences with other treatments except for those pollinated with “Boyer”, so the increase in fruit size was a result in the increase of fruit diameter, in addition, differences in fruit shape were observed among treatments (Table 3).

Table (2): Effect of date palm males (pollens) on fruit set%, total yield (kg) and average bunch weight (kg) of Barhi variety.

Treatment	Fruit set%	Total Yield (kg)	Av. Bunch wt. (kg)
Boyer	72.5 a	134.7 a	26.9 a
Barakah	67.2 ab	128.0 a	25.6 a
Jarvis	65.2 ab	111.7 a	22.3 a
Mejhool	65.8 ab	122.7 a	24.5 a
Aqaba	55.9 b	109.0 a	21.8 a
Dayyat1	70.3 a	132.3 a	26.5 a

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

Table (3): Effect of pollens on fruit weight (gm), length, diameter (mm) and Length/Diameter(L/D) of Barhi variety.

Treatment	Av. Fruit wt. (gm)	Av. Fruit length (mm)	Av. Fruit diameter (mm)	L/D
Boyer	8.4 b	29.0 a	22.8 b	1.27 a
Barakah	9.8 ab	28.8 a	24.7 ab	1.20 abc
Jarvis	10.1 ab	29.1 a	24.4 ab	1.17 bc
Mejhool	10.5 a	29.7 a	24.5 ab	1.23 ab
Aqaba	11.3 a	29.8 a	25.6 a	1.13 c
Dayyat1	9.9 b	29.9 a	23.7 ab	1.27 a

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

5- Seed Weight, Length and Diameter:

Trees pollinated with “Barakah” gave the least seed weight and diameter (0.8 gm) but with no significant differences with other treatments except for those pollinated with “Aqaba” and “Mejhool” which gave the

largest seed weight (1.0 gm for both) and those pollinated with “Aqaba” for seed diameter (9.3 mm). No significant differences among treatments were observed with respect to seed length and Length/Diameter ratio (Table 4).

Table (4): Effect of pollens on average seed weight (gm), seed length (mm) and diameter (mm) of Barhi variety.

Treatment	Av. Seed wt. (gm)	Av. Seed length (mm)	Av. Seed diameter (mm)	L/D
Boyer	0.9 ab	16.0 a	9.2 ab	1.8 a
Barakah	0.8 b	16.1 a	8.6 b	1.9 a
Jarvis	0.9 ab	19.0 a	9.1 ab	1.8 a
Mejhool	1.0 a	16.7 a	9.1 ab	1.9 a
Aqaba	1.0 a	16.5 a	9.3 a	1.8 a
Dayyat1	0.9 ab	17.0 a	9.2 ab	1.8 a

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

Table (5): Effect of pollen on maturity % (w/w), flesh % and Total Soluble Solids (TSS %) of Barhi variety.

Treatment	Maturity %	Flesh %	TSS%
Boyer	13.2 abc	89.1 b	36.3 a
Barakah	20.1 a	91.6 a	41.8 a
Jarvis	17.5 ab	91.0 ab	39.7 a
Mejhool	10.9 bc	90.7 ab	38.8 a
Aqaba	7.9 c	91.8 a	38.0 a
Dayyat 1	10.4 bc	90.7 ab	36.3 a

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

6- Fruit Maturity:

Trees pollinated with “Barakah” increased fruit maturity of “Barhi” trees (20.1 %) but with no significant differences compared to “Jarvis” and “Boyer” males, however, trees pollinated with “Aqaba” significantly delayed fruit maturity (7.9 %) (Table 5).

7- Flesh Percentage:

Trees pollinated with “Aqaba” and “Barakah” gave the highest flesh weight % (91.8 and 91.6 %, respectively) but with no significant differences compared to other treatments except for those pollinated with “Boyer” which gave the least flesh weight % (89.1 %) (Table 5).

8- Total Soluble Solids (TSS %):

No significant differences were observed among treatments with respect to fruit Total Soluble Solids (TSS %), however, trees pollinated with “Barakah” gave the highest fruit TSS % (41.8 %) while those pollinated with “Boyer” and “Dayyat1” gave the least fruit TSS% (36.3 and 36.3 %, respectively) (Table 5).

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-Sabrou, 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 female 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 it is 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 (TSS).

Al-Ghamdi *et al.* (2002) concluded that there are without any 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.

When studying these results, a noticeable trend can be observed in the relation between "Barhi" fruit set and average fruit weight and to some extent fruit maturity of "Barhi", since pollinating trees with pollen from "Aqaba" male had lowered fruit set but at the same time it gave the highest fruit weight for this variety, this caused a noticeable delay in the maturity of such fruits. The opposite occurred when "Barhi" trees were pollinated with "Boyer" male. These results are in agreement with Monselise (1996) who stated that pollen, which produced smaller fruits and seeds also produced earlier ripening.

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