

Evaluation of Date Palm Males Types as Pollinators for Zaghloul and Samany Date Palm cvs. Grown in Qalyubia Governorate

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ABSTRACT

Three different date palm male types Maghal (M1, M2 and M3) were chosen to evaluate which male could be recommended to use as a pollinator for Zaghloul or Samany date palm cultivars grown in Experimental Station at El Kanater El Khayreia, Kalubia Governorate, Egypt. Number of days to spathe opening, spathe weight, length and width of spathe and pollen grains germination were determined for each male date palm tree from each male type. Moreover, pollen grains from each male type were used as a pollinator to evaluate their effect on fruit set and fruit quality of Zaghloul and Samany date palm cultivars. The study was carried out during 2014 and 2015 seasons. Data showed that (Male1) type was superior for fruit set and fruit quality of two cultivars (Zaghloul and Samany). On the other hand, data also revealed that dates which produced with Male1 type had the highest total soluble solids (T.S.S) value and sugars of fruits of two cultivars, under study. As for Hababauk stage, had the highest fruit set for two cultivars (Zaghloul and Samany), while the Tamer stage gave highest values for all physical properties under study.

Key words: Male type, Date palm cultivars, Floral characteristics, Fruit set, Hababauk and Tamer stages

Introduction

Date palm is one of the oldest known and cultivated fruit trees in Egypt and Arab countries. It is a dioecious with female and male trees or plants flowers occurring on separate plants, so artificial pollination is essential for economical crop. Many investigators proved that pollen grain from different male date trees not only influence the size and shape of seed "Xenia" but also has a direct effect on fruit set, yield and fruit characteristics "Metaxenia (Mathew *et al.*, 1975; El-Hamadi *et al.*, 1977). El-Salhy *et al.* (1997) reported that pollen sources had positive affect on fruit and seed characteristics. Moreover, it exhibited metaxenic effect depending on the female cultivar used. Recently, several investigators mentioned that both productivity and quality of date palm were affected by source of pollen grains (Aly, 2001; Khamis *et al.*, 2010 and Omaira *et al.*, 2014). The chemical composition of the date fruits of palm cultivars has been studied by several workers (Hussein, *et al.*, 1999 ; Marzouk *et al.*, 2002 ; Iqbal *et al.*, 2004 and Al-Hamoudi *et al.*, 2006). Date palm takes about 200 days from pollination to full maturation (Tamer stage). During its development and ripening, the fruit passes through four stages are named by their Arabic denomination; Kimri, Khalal, Rutab and Tamer stages. Hababauk is the term used for the female flower and the period just after pollination when the young fruit is still creamy white before gradually turning green at the Kimri stage. At this stage, there is rapid increase in size and weight of fruit. Fruit turning from green to yellow or red according to the variety and that is the initiation of Khalal stage. At this stage (Khalal) the fruit weight gain is slow but sucrose content is increased, moisture content goes down, tannins precipitate and lose their astringent (Godara *et al.*, 1994).

For this the aim of this study was to determine the effect of using different pollen grain sources on yield and fruit quality of Zaghloul and Samany cultivars date palm. Therefore, it carried out to evaluate chemical changes in stages of fruit development (Khalal and Tamer stages). Such studies are considered important in determining the proper harvest time.

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Material and Methods

This study was carried out during 2014 and 2015 experimental growing seasons in Horticulture Research Station at El Kanater El Khayreia, Kalubia Gvernorate, Egypt. Three males palm trees were selected, healthy and nearly uniform in vigour as possible and subjected to the same cultural practices commonly adopted in the orchard. The mature male spathes were cut off from three male types/ namely M1, M2 and M3. The number of days was counted from spathe emergence to opening of three spathe of each male tree.

The length and width of three spathes were measured by tape. Twenty-five strands lengths were measured and average were reported. Total number of flowers present on the three strands was counted and mean was calculated. Pollen grains from flowers were placed in desicators for 24 h for absorption of moisture and then weighed. Pollen viability was determined by germination test in a nutrient media consisted of 20% sucrose according to the method followed by Asif *et al.* (1983). Furthermore, Zaghoul and Samany date palm cultivars grown in the same experimental station of about twenty years old planted at 8x8 m² apart in a clay soil. Three female spathes on each palm tree were pollinated directly after spathe carking with one of the three male types. Hand pollination was done by dusting the dry pollen grains, then they were placed within the strands of the female spathe. Each spathe was pollinated with an equal amount of pollen grains. After pollination, the female spathes were covered with perforated paper bags to prevent any contamination with foreign pollen grains. The bags were carefully tied around the end of the spathe and then shaken gently to insure the spread of pollen grains among the female flowers. After two weeks, the bags were removed. The number of flowers and fruit setting on six female strands were recorded after one month of pollination and then fruit set percentage was calculated as following equation:

$$\text{Fruit set \%} = \frac{\text{Number of fruits setting on the strand}}{\text{Total number of flowers per the same strand}} \times 100$$

The bunches of all treatments were harvested of (Khalal and Tamer stage). Three samples from each treatment were picked randomly. Each sample contained 25 fruits for determination the physical and chemical properties.

The physical properties of fruits included fruit weight (g), size (cm³), shape (L/D), seed weight (g) and flesh percentage. The chemical property of fruits included percentages of Total Soluble Solids (TSS %), was determined in the fruit juice by hand refractometer and total acidity % was calculated as malic acid according to A.O.A.C., (2000). The sugar fractions (glucose, glurutose and sucrose) were determined by high performance liquid chromatography (HPLC) according to the method as described by Myhara *et al.* (1999) with slight modifications. The instrument was calibrated with freshly prepared standard solutions of five sugars.

Statistical analysis:

The obtained data in both seasons were statistically analyzed using analysis of variance method according to Snedecor and Cochran (1989).

Results and Discussion

Variation between floral characteristics of three seedling date palm males used in pollination of Zaghoul and Sammany cvs.

In this respect spathe length, spathe width, spathe fresh weight, weight of pollen, strand length, No. of days to spathe opening, No. of flowers per strand and pollen germination percentage were the investigated measurements during 2014 and 2015 experiential seasons. Data obtained in Table (1) shows obviously a considerable variations in this respect. Herein, the greatest spathe length and width were significantly coupled with Male (1) during both seasons of study. Whereas, Male (2)

showed the effective in spathe length and width during 2015 experiential season. Moreover, spathe fresh weight was statistically the superior with Male (2) during seasons of study. In addition Male (1) gave the highest strand length. Whereas, Male (2) ranked statistically second. Such trend was true during 2014 and 2015 experiential seasons. Hence, the greatest number of days to spathe opening was significantly in closed relationship to the Male (3) during both 2014 and 2015 seasons. However, number of flower per strand and pollen germination % followed the same trend previously detected with spathe length and width. The greatest number of flower per strand and pollen germination percentages were significantly coupled with Male (1). On the contrary, the lowest number of flower per strand and pollen germination % were significantly induced from Male (3) during 2014 and 2015 experiential seasons.

Table 1: Variation between floral characteristics of three seedling date palm males used in pollination of Zaghloul and Sammany cvs. during 2014 and 2015, seasons.

Pollinizer	Spathe length (cm)	Spathe width (cm)	Spathe fresh weight (kg)	Weight of pollen (g)	Strand length (cm)	No. of days to spath opening	No. of flower per strand	Pollen germination (%)
2014								
Male 1	88.08	20.66	1761	188.6	31.20	21.80	64.80	86.42
Male 2	77.73	19.70	2007	312.6	25.00	26.60	53.60	77.97
Male 3	68.12	15.94	1668	193.4	13.00	30.80	47.80	58.28
L.S.D	7.67	1.052	88.01	15.58	0.639	2.78	2.48	4.97
2015								
Male 1	84.88	19.20	1852	189.9	33.00	27.40	55.40	93.33
Male 2	77.76	18.63	1971	289.5	24.80	31.80	44.40	81.71
Male 3	60.95	16.76	1738	163.2	14.00	38.20	38.20	71.30
L.S.D	10.58	0.836	107.40	21.63	1.966	2.61	3.38	4.12

These results are in accordance with the finding of Naser *et al.* (1986b), Marzouk *et al.* (2002) and Iqbal *et al.* (2004 & 2009) who reported that males differ regarding the number of flowers per strand. The data revealed that male pollen grains varied significantly due to pollen viability (Table1). The maximum germination of pollens (86.42 and 93.33%), were recorded in M1, whereas the minimum germination of pollens (58.28 and 71.30%) were recorded in M3 consecutively in the two studied seasons. These results agree with the findings of Naser *et al.* (1986) who stated that males differed greatly in pollen viability percentage. Iqbal *et al.* (2009) finding that variation in viability of pollen is due to genetic characters of the male.

Effect of different three types of males on fruit set percentage of Zaghloul and Samany cvs.

Table (2) displays obviously the three types of males increased significantly fruit set %. However, Male (1) was statistically the superior with Zaghloul date palm cv. during both seasons whereas, Male (1) gave the greatest fruit set % in Samany date palm cv. in 2nd season. Meanwhile Male (2) was the superior with Samany date palm cv. during 2014 experiential season. In addition Male (3) was the least effective with Zaghloul and Samany date palm cvs. during 2014 and 2015 experiential seasons. On the other hand, Hababauk stage was statistically the superior, whereas it resulted the greatest fruit set % with Zaghloul and Samany date palm cvs. during both seasons of study.

Anyhow, These results are in agreement with those obtained by Bacha *et al.* (1986) found that the type of pollen used in pollination affected fruit setting, yield and fruit quality with various degrees and that such effect varied depending on the females cultivars used. Also, these results are in agreement with those obtained by El-Salhy *et al.* (1997) on Zaghloul and Samany cultivars date palm under Assiut condition; Kamis *et al.* (2010) on Siwi and Zaghloul cultivars. Ommima *et al.* (2015) on Samany cultivar.

Table 2: Effect of different three types of males on fruit set percentage of Zaghloul and Samany cvs. during 2014 and 2015 seasons.

Pollinizers		Zaghloul		Samany	
		2014	2015	2014	2015
Male	Male 1	69.52	72.38	64.57	73.65
	Male 2	63.52	65.32	71.05	65.29
	Male 3	52.99	54.06	57.74	56.68
	L.S.D	6.66	4.99	5.97	6.43
Stages	Habbok	68.32	69.71	73.33	76.61
	Khalal	55.70	58.13	55.58	53.81
	L.S.D	5.44	4.07	4.87	5.25

Effect of different three types of males on some fruit physical properties of Zaghloul and Samany cvs.

In this regard some fruit physical properties i.e., fruit weight, size, fruit shape index, seed weight and flesh percentage were the evaluated fruit physical characteristics of both Zaghloul and Samany date palm cvs. in response to different three types of males during 2014 and 2015 experiential seasons presented in Table (3). It is quite evident that the greatest increased in the above mentioned measurements were statistically detected by Male (1) in both Zaghloul and Samany date palm cvs. during both 2014 and 2015 experiential seasons except flesh percentage with Samany date palm cv. which gave the highest value by using Male (2) in the 2nd season only. Moreover, Male (2) ranked statistically second with few exceptions with seed weight in Samany date palm cv. and fruit shape with the same cv. Herein Male (3) ranked statistically second. Moreover, in Tamer stage all the investigated measurements increased significantly compared to Khalal stage with so few except with flesh % and seed weight. Such trend was true during both 2014 and 2015 experiential seasons.

Table 3: Effect of different three types of males on some fruit physical properties of Zaghloul and Samany cvs. during 2014 and 2015 seasons.

Pollinizer	Stages	Zaghloul					Sammany				
		Fruit Weight (g)	Fruit Size (m)	Fruit shape (L/D)	Seed weight (g)	Flesh (%)	Fruit weight (g)	Fruit Size (m)	Fruit shape (L/D)	Seed weight (g)	Flesh (%)
2014											
Males	Male1	26.87	40.33	2.18	2.41	91.58	31.62	41.17	1.92	3.20	89.22
	Male2	24.24	36.75	1.99	2.39	91.07	29.48	40.50	1.65	2.76	89.63
	Male3	21.30	29.83	2.06	1.71	90.25	24.34	36.17	1.58	2.64	87.48
stages	Kahlal	25.05	34.78	1.97	2.10	90.25	23.35	43.83	1.63	2.68	86.86
	Tamr	23.22	36.50	2.18	2.25	91.68	33.50	34.72	1.80	3.04	90.70
L.S.D	Males	1.11	1.58	0.12	0.23	1.18	1.39	0.68	0.13	0.37	1.34
	Stages	0.91	1.29	0.09	0.19	0.97	1.13	0.56	0.11	0.31	1.10
2015											
Males	Male1	27.02	38.25	1.94	2.20	91.63	31.62	34.92	1.72	3.24	90.70
	Male2	25.65	36.08	2.05	2.12	91.81	29.48	35.17	1.68	2.94	89.86
	Male3	23.10	28.83	2.22	2.13	89.30	24.34	31.00	1.79	3.04	88.40
stages	Kahlal	25.91	33.44	2.03	2.12	90.60	23.35	33.67	1.68	2.83	89.96
	Tamr	24.61	35.33	2.10	2.17	91.23	33.61	33.72	1.78	2.31	89.35
L.S.D	Males	1.14	0.45	0.10	0.25	0.81	1.46	0.88	0.08	0.32	1.63
	Stages	0.94	0.37	0.08	0.28	0.66	1.20	0.72	0.06	0.26	1.33

Effect of different three types of males on fruit chemical characteristics of Zaghloul and Samany cvs. during 2014 and 2015 seasons.

In this regard fruit juice total soluble solids (TSS) %, total acidity %, sucrose mg/100g, Glucose mg/100g and Gluructose mg/100g were the five investigated fruit juice chemical properties for Zaghloul and Samany date palm cvs. regarding their response to the different three males (Male1, Male2 and Male3). Data obtained during both 2014 and 2015 experimental seasons are presented in table (4). Table (4) displays obviously that the highest TSS% was markedly coupled with Male (1) with both Zaghloul and Samany date palm cvs. during 1st and 2nd experimental seasons. Moreover, Male (1) gave the highest values in total acidity % with Samany date palm cv. during 2014 and 2015

seasons. Meanwhile, Male (2) gave the highest values in total acidity % with Zaghloul date palm cv. during both seasons. On the other hand, the superiority of Male (1) for induced the highest values of Sucrose and Gluructose mg/100g with Zaghloul date palm cv. during 2014 and 2015 experimental seasons. Meanwhile, in Samany date palm cv. the trend was different. Anyhow, Male (1) gave the highest values of Gluructose mg/100g with Samany date palm cv. during both seasons. In additions, Male (3) gave the highest values of Glucose mg/100g with the same cv.. Never the less, Glucose contents in Zaghloul date palm cv. not found with the different three types of males (1,2 and3) during 2014 and 2015 seasons. Meanwhile, the produced of Glucose was significantly in closed relationship to Male (2) with Samany date palm cv. only. Such trend was true during two experimental seasons.

Generally it could be safely concluded that Male (1) increased significantly the studied fruit quality measurements in most cases as compared to the other Males (Male2 and Male 3). Whereas, differences between Male (2) and Male (3) were so slight to reach level of significance during both 2014 and 2015 experimental seasons. Such trend may be attributed to the stimulative effect of Male (1) which have the best pollen grains and consequently well pollen grains certainly would be reflected positively effect on different fruit quality properties (Metaxenia).

Moreover, these results are in general agreement with El-Hammady *et al.* (1977); El-Sabrou (1979); Bacha *et al.* (1986); Gasim (1993); Desoukey *et al.* (1993) finding that Pollen has a direct influence on fruit physical and chemical characteristics known as metaxenia effect. Pollen influence percent of fruit set, fruit shape, size, T.S.S. Also, these results are in general agreement with Marzouk, *et al.* (2002), on Zaghloul and Samany date palm cultivars, for yield and fruit quality. Moreover, Mansour, (2005) who reported that the fruit weight was 23.80 g in Samany cultivars, Jalal and Hani (2006) studied the effect of six pollen types on Barhy date palm, found that the increase in fruit size was a result in the increase of fruit diameter, in addition, differences in fruit shape were observed according to the used of different pollen type. Sakr, *et al.* (2010) found that the highest fruit length/fruit diameter ratio was 2.59 and 2.21 in Kuboshy and Zaghloul cultivars while the lowest ratio was 1.67and 1.38 in Barhy and Samany cultivars.

Similar results were reported by many authors such as Abou Aziz *et al.* (1982), Abo-El-Ez *et al.* (2002) and Ommima *et al.* (2013) reported that Samany date palm gave the lowest TA % values than those of Zaghloul date palm. In their experiment, Tavakoli *et al.* (2014) studied the effect of four pollen types included Jarvis, Bami, Zard Parak, and Sabz Parak on Mazafati date, found that the fruit's acidity was in their highest rates in Kahlal stage and in their lowest rate in Tamar stage. Also, these results are in agreement with those reported on Hayany date palm, Merwad *et al.* (2015).

Table 4: Effect of different three types of males on fruit chemical characteristics of Zaghloul and Samany cvs. during 2014and 2015 seasons.

Pollinizer Stages		Zaghloul					Samany				
		T S S (%)	Total acidity (%)	Sucrose mg/100g	Glucose mg/100g	Gluructose m g / 1 0 0 g	TSS (%)	Total acidity (%)	Sucrose mg/100g	Glucose mg/100g	Gluructose mg/100g
2014											
Male	Male1	22.93	0.58	8.84	0.0	0.51	18.63	0.52	0.00	9.95	1.06
	Male2	19.87	0.62	1.11	0.0	0.16	17.93	0.43	0.74	12.88	0.83
	Male3	18.17	0.57	0.00	0.0	0.60	15.30	0.38	0.00	18.23	0.61
	L.S.D	1.870	0.070	0.661		0.071	1.415	0.057	0.189	1.284	0.143
2015											
Male	Male1	20.67	0.53	9.25	0.0	0.68	17.83	0.55	0.00	11.06	1.15
	Male2	18.60	0.55	1.54	0.0	0.23	16.27	0.45	0.86	14.33	0.87
	Male3	16.32	0.44	0.00	0.0	0.74	14.30	0.36	0.00	16.63	0.76
	L.S.D	1.774	0.012	0.702		0.035	1.317	0.070	0.124	0.820	0.175

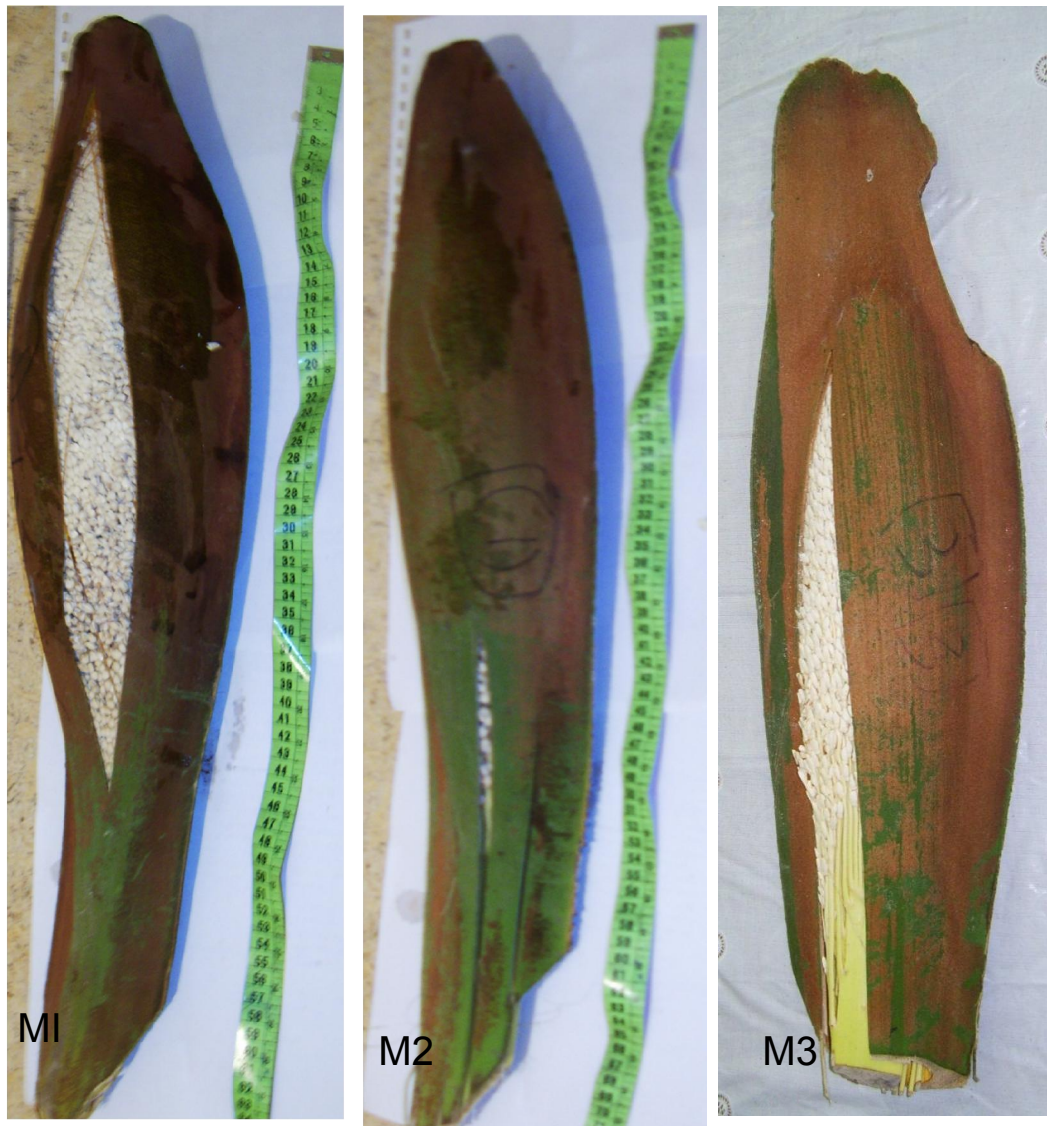


Photo 1: Different in shapes and size between the three types male" spathes".
M1= Male1, M2= Male2 and M3= Male 3

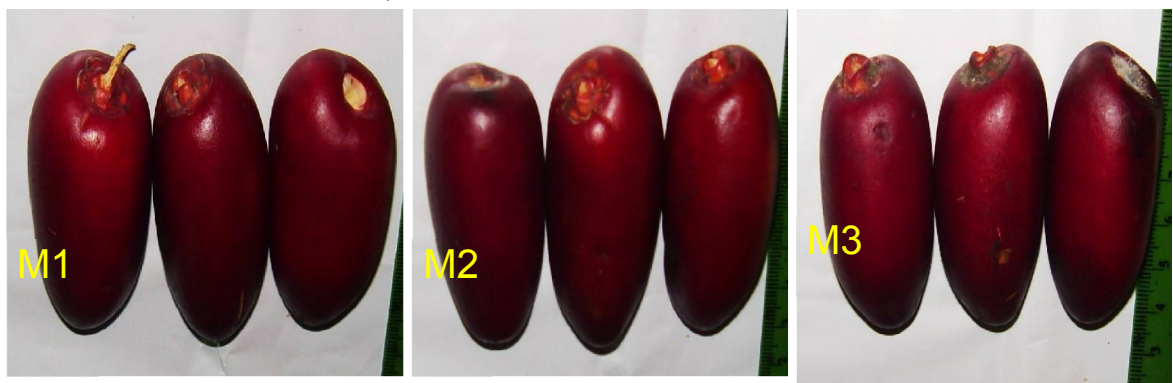


Photo 2: Effect of different three types of males on fruit shapes and size of the studied date palm genotypes: Zaghloul cv. (M1= Male1, M2= Male2 and M3= Male3)



Photo 3: Effect of different three types of males on fruit shapes and size of the studied date palm genotypes: Samany cv. (M1= Male1, M2= Male2 and M3= Male3)

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