

## Effect of Different Hand Pollination Methods on Fruit Retained, Yield and Fruit Quality of Some Egyptian Dry Date Palm Cultivars

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**T**HREE hand pollination methods : (A) Ten male strands, (3 g pollen grains), were inserted in the center of each female inflorescence (control treatment). (B) Bestrewing a mixture of pollen grains and wheat flour (3: 6 g) on each female inflorescence. (C) Putting a piece of cotton dusted with a mixture of pollen grains and wheat flour (3: 6 g) in the center of each female inflorescence. All previous methods were applied on Sakkoty, Gondaila and Dagana female dry date palm (*Phoenix dactylifera* L.) cultivars during two successive seasons of 2000 and 2001 at Kom Ombo, Aswan, Egypt. Fruit retained and bunch weight, (yield), were increased significantly with control than all methods. Also, all methods enhanced the fruit physical and chemical characters than control (A). It was clearly observed that method (B) raised fruit weight, fruit size, pulp weight, fruit length and fruit diameter. In addition, fruit chemical characters (fruit moisture content, total soluble solids, total sugars, reducing sugars and non-reducing sugars percentages) were significantly increased with methods B and C than control.

The hand pollination is an ancient practice in date palm culture and it is necessary to commercial fruit production. The most common method of pollination is to cut the strands of male flowers from a freshly opened male inflorescence and insert 2 to 5 strands of them into female inflorescence (Nixon, 1928, 1934 & 1955 and Brown & Bahgat, 1938). Some growers have placed whole or parts of male bloom in several female palms in a garden hoping to provide enough wind-borne pollen, (Nixon, 1956 and Sial, 1980).

The most modern ways of pollinating the trees as practiced by many of today's growers actually differs very little from the ancient ways, except that the

pollen is first applied to wads of cotton or palm fibrous sheath, which are then placed between the strands of the female clusters (Brown *et al.*, 1970; Simon, 1978; Moustafa, 1985 and Tisserate *et al.*, 1985). The limited supply of date palm pollen can be extended by mixing the pollen with wheat flour (as a carrier), makes it possible to use small quantities of pollen for date palm pollination (Khalil & Al-Shawaan, 1983; Moustafa, 1994 and Attalla & Sharran, 1999). Many workers mentioned that flour was used as a carrier with the conventional dusting equipment in order to achieve uniform distribution of pollen being applied (Perkins & Burkner, 1973 and Moustafa, 1985 & 1994).

Also, since a very small quantity of pollen is required, pollen and flour are mixed to increase the total quantity (Brown & Perkins, 1969; Brown, 1983 and Brown *et al.*, 1984). El-Kassas & Mahmoud (1986) reported that using 20 -40% pollen grains mixed in talc powder as a carrier for cv. Zaghloul date palm under Assuit conditions, gave satisfactory yield and good quality fruits. Addition of carrier also helps in even good distribution of pollen over a large area when a small amount of pollen is intended for use (Sial & Khalid, 1985).

The present study aims to enhance fruit retained percentage, bunch weight and total yield of palm tree and to improve the fruit physical and chemical characteristics. In addition to insuring a good distribution of pollen over a large area when a small amount of pollen is intended for use. Thus, different hand pollination methods were used for Sakkoty, Gondaila and Dagana dry date palm cultivars under Kom Ombo, Aswan conditions.

### Material and Methods

This study was carried out during two successive seasons of 2000 and 2001. Three female dry date palm (*Phoenix dactylifera*, L.) "Sakkoty, Gondaila and Dagana" cultivars were used. They were grown on the clay soil in the Ministry of Agriculture Experimental Station at Kom Ombo, Aswan Governorate, Egypt. Three hand pollination methods were used as follows:

- (1) Ten male strands (3 g pollen grains) were inserted in the center of each female inflorescence (control), (Method, A).
- (2) Bestrew a mixture of pollen grains and wheat flour (3: 6 g) on each female inflorescence using talc bottle (Method, B).
- (3) Putting a piece of cotton dusted with a mixture of pollen grains and wheat

flour (3:6 g) in the center of each female inflorescence (Method, C). Pollen grains were collected from selected male palms grown vigorously in the same region in both seasons. Pollination was done one times in the third week (in the first season) and in the second week (in the second season) of March after three days from inflorescence cracking. Three female palms were selected similar in growth, production, age (30 years old) and moderate punning (10:1 leaf / bunch ratio, Hussien *et al.*, 1998) for each cultivar. Only twelve bunches were left on each female palm and divided into three groups. Each group (three bunches) was pollinated with one of the above mentioned methods. The female bunches were covered by paper bags before and after pollination and one bunch was left between each group (three bunches) to avoid the mixing between different methods used.

#### *Data analysis*

The design used was randomized complete block in factorial arrangement with three replicates (Snedecor, 1956), The characters were compared using L. S. D. at 5% level.

The yield of fruits for this experiment was harvested at the second week of October in both seasons and the following characters were determined.

- a. The average bunch weight was estimated by Kg.
- b. Fruit retained percentage: the average fruit retained percentage was calculated at harvest using this equation:

$$\text{Fruit retained \%} = \frac{\text{Total number of retained fruits per bunch}}{\text{Total nodes number per bunch}} \times 100$$

- c. Fruit physical characters

Samples of three replicates, each of 10 fruits were taken randomly from each bunch to determine fruit size and fruit dimensions (length and diameter, in cm), fruits weight, fruit flesh weight and seed weight (in grams).

- d. Fruit chemical characters

1. Moisture content : According to A. O. A. C. (1995).
2. Total soluble solids: The percentage of TSS was determined in the fruit juice using zice refractometer (A. O. A. C., 1995).

3. Fruit acidity: Fruit acidity was determined according to A. O. A. C. (1995) and the titrable acidity was calculated as citric acid (Mawlood, 1980).
4. Total soluble sugars: It was determined according to Smith *et al.* (1956) in the methanolic extract using the phenol sulphuric acid method and the percentage was calculated per dry weight.
5. Reducing soluble sugars: It was determined in the methanolic extract according to Nelson & Somogy (1944) and A. O. A. C. (1995). The percentage was calculated per dry weight.
6. Non-reducing sugars: It was determined by the difference between total and reducing sugars.

### Results and Discussion

#### *Average bunch weight*

Concerning the average bunch weight, Table 1 indicated that different hand pollination methods significantly affected bunch weight in both seasons for all cultivars under studies. Method (A) gave the highest bunch weight followed by methods (C and B, respectively) in both seasons. Also, Sakkoty gave the highest bunch weight followed by Gondaila and Dagana cultivars in both seasons, respectively.

**TABLE 1. Effect of different hand pollination methods on bunch weight (Kg) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000				Season 2001			
	Sakkoty	Gondaila	Dagana	Mean	Sakkoty	Gondaila	Dagana	Mean
(A) Pollen strands	7.12	7.07	6.33	6.48	7.00	8.00	7.17	7.39
(B) bestrewing Pollen + flour (3:6g)	4.92	4.17	4.66	4.58	5.33	4.17	4.50	4.67
(C) Cotton with Pollen + flour (3:6g)	6.00	5.50	5.47	5.66	6.33	6.17	6.33	6.28
Mean	6.01	5.58	5.49	-	6.22	6.11	6.00	-

LSD at 5 % level for :

Cultivars (A)	Season 2000	Season 2001
	= 0.5066	0.3365
Hand pollination methods (B)	= 0.5849	0.3886
A X B	= 1.0130	0.6731

The interaction between different hand pollination methods and cultivars showed that method (A) gave the highest bunch weight with three cultivars under studies followed by method (C and B) in both seasons, respectively.

These results are in disagreement with Hussain *et al.* (1985) and Moustafa (1985). They reported that dusting female inflorescence with mixture of pollen grains and wheat flour (1:1, w:w) was more effective in increasing the average bunch weight for date palm trees than other hand pollination ways. However, Attalla & Sharran (1999) reported that the highest bunch weight was obtained with 15% pollen powder diluted with wheat flour. On the other hand, El-Kassas & Mahmoud (1986) reported that using 20 -40% pollen grains in talc powder as a carrier for Zaghoul date cv. under Assiut conditions gave satisfactory yield and good fruit quality. Also, Moustafa (1994) reported that dusting treatment gave a slightly lower but satisfactory bunch weight for both investigated cultivars comparing with traditional pollination treatment (control) .

#### *Fruit retained percentage*

Fruit retained was significantly affected by all different hand pollination methods for all cultivars under studies (Table 2). Also, control (method A) gave the highest fruit retained percentage followed by (C and B) methods in both seasons, respectively. In addition, Dagana cv. gave the highest fruit retained percentage followed by Gondaila and Sakkoty cvs. in both seasons, respectively.

**TABLE 2. Effect of different hand pollination methods on fruit retained (%) of some date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000			Mean	Season 2001			Mean
	Sakkoty	Gondaila	Dagana		Sakkoty	Gondaila	Dagana	
(A) Pollen strands	27.57	40.57	40.93	36.36	36.53	42.17	44.80	41.17
(B) bestrewing Pollen + flour (3:6g)	24.23	37.17	38.97	33.46	30.97	39.17	40.90	37.01
(C) Cotton with Pollen + flour (3:6g)	26.07	38.70	40.10	34.96	36.47	39.93	41.50	39.30
Mean	25.96	38.81	40.00	-	34.66	40.42	42.40	-

LSD at 5% level for :  
 Season 2000  
 Cultivars (A) = 1.058  
 Hand pollination methods (B) = 1.222  
 A X B = 1.117  
 Season 2001  
 = 1.531  
 = 1.768  
 = 3.062

The interaction between cultivars and different hand pollination methods indicated that control gave the highest percentage of fruit retained followed by methods (C and B) with three cultivars in both seasons respectively. Also, Dagana cv. gave the highest fruit retained percentage with control followed by Gondaila and Sakkoty cvs. in both seasons, respectively.

These results are in disagreement with those reported by Hussain *et al.* (1985) and Moustafa (1985) who found that dusting the female inflorescence with mixture of pollen grains and flour (1:1,w:w) gave the highest fruit set percentage than placing 12 male strands within each female inflorescence. In Addition, Attalla & Sharran (1999) found that dusting by 5,10 and 15% pollen powder diluted with wheat flour raised significantly the average fruit set percentage in Sukari and Qassim date palm cultivars. Whereas, Moustafa (1994) found that male inflorescence gave the highest fruit set percentage followed by a mixture of pollen and fine wheat flour.

### Physical characters

#### Fruit size

Data presented in Table 3 clearly indicated that fruit size of Sakkoty, Gondaila and Dagana date palm cultivars were significantly affected by different hand pollination methods in both seasons. It was clearly noticed that method (B) gave the highest fruit size than method (C) and control in both seasons for all cultivars. Also, Sakkoty cultivar had the highest fruit size followed by Gondaila and Dagana in both seasons.

**TABLE 3.** Effect of different hand pollination methods on fruit size ( $\text{cm}^3$ ) of some dry date palm cultivars in 2000 and 2001 seasons.

Hand pollination methods	Season 2000				Season 2001			Mean
	Sakkoty	Gondaila	Dagana	Mean	Sakkoty	Gondaila	Dagana	
(A) Pollen strands	9.92	7.28	4.13	7.11	9.30	6.07	3.63	6.33
(B) bestrewing Pollen + flour (3:6g)	13.80	11.10	8.90	11.27	13.17	10.17	8.00	10.45
(C) Cotton with Pollen + flour (3:6g)	13.67	8.33	6.82	9.61	13.00	8.23	6.17	9.13
Mean	12.46	8.90	6.62	-	11.82	8.16	5.93	-

LSD at 5 % level for:

	Season 2000	Season 2001
Cultivars (A)	= 0.1931	0.1231
Hand pollination methods (B)	= 0.2229	0.2239
A X B	= 0.3861	0.3311

In addition, the interaction between cultivars and different hand pollination methods showed that method (B) gave the highest fruit size with Sakkoty, Gondaila and Dagana cultivars in both seasons. It was clearly noticed that, method (A, control treatment) recorded the smallest fruit size with Dagana cultivar in both seasons.

These results are in agreement with those reported by Moustafa (1994) who found that the traditional pollination method gave the smallest fruit size comparing with all investigated methods in Zaghloul and Samani cultivars during three successive seasons.

#### *Fruit dimensions*

*Fruit length* : Results in Table 4 showed that fruit length was significantly affected by different hand pollination methods for Sakkoty, Gondaila and Dagana cultivars in both seasons. Method (B) gave the longest fruit than method (C) and control (Method A), in both seasons. Sakkoty cultivar gave the longest fruit followed by Gondaila and Dagana cultivars in both seasons, respectively.

**TABLE 4. Effect of different hand pollination methods on fruit length (cm) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000			Mean	Season 2001			Mean
	Sakkoty	Gondaila	Dagana		Sakkoty	Gondaila	Dagana	
(A) Pollen strands	5.17	4.03	2.92	4.04	5.10	4.03	2.61	3.91
(B) bestrewing Pollen + flour (3.6g)	5.58	4.50	4.55	4.88	5.48	4.12	4.51	4.70
(C) Cotton with Pollen + flour (3.6g)	5.54	4.40	4.15	4.70	5.37	4.07	4.26	4.57
Mean	5.43	4.31	3.87	-	5.32	4.07	3.79	-

LSD at 5% level for :

	Season 2000	Season 2001
Cultivars (A)	= 0.4259	0.0757
Hand pollination methods (B)	= 0.4917	0.0874
A X B	= 0.8517	0.1515

The interaction between cultivars and different hand pollination methods obtained that method (B) gave the highest fruit length with three cultivars under studies followed by method (C) and control in both seasons, respectively.

*Fruit diameter* : Data in Table 5 indicated that all different hand pollination methods significantly affected on the average fruit diameter for Sakkoty, Gondaila and Dagana dates in both seasons. Method (B) gave the highest fruit diameter followed by method (C and A) in both seasons, respectively. Sakkoty fruit diameter was the highest than Gondaila and Dagana cultivars in both seasons, respectively.

**TABLE 5. Effect of different hand pollination methods on fruit diameter (cm) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000				Mean	Season 2001			
	Sakkoty	Gondaila	Dagana	Mean		Sakkoty	Gondaila	Dagana	Mean
(A) Pollen strands	1.92	1.90	1.73	1.85	1.94	1.91	1.70	1.85	
(B) bestrewing Pollen + flour (3.6g)	2.31	2.14	2.15	2.20	2.40	2.12	2.11	2.21	
(C) Cotton with Pollen + flour (3.6g)	2.07	2.03	1.95	2.02	2.31	2.10	1.92	2.11	
Mean	2.10	2.02	1.94	-	2.22	2.04	1.91	-	

LSD at 5 % level for :

Cultivars (A)	Season 2000	Season 2001
Hand pollination methods (B)	= 0.2677	0.0463
A X B	= 0.0303	0.0535
	= 0.0535	0.0927

The interaction between cultivars and different hand pollination methods showed that method (B) gave the highest fruit diameter with Sakkoty, Dagana and Gondaila cvs. followed by (C and A) methods in both seasons, respectively.

These results are in agreement with those reported by Hussain *et al.* (1985) and Mostafa (1994) who found that the traditional hand pollination method gave the smallest fruit length and diameter than all other hand pollination methods when used Zaghloul and Samani cultivars. On the contrary, Moustafa (1985) reported that the different hand pollination methods did not give any significant effect on fruit length and diameter in Seewy date palm.

#### *Fruit weight*

Data presented in Table 6 indicated that all different hand pollination methods significantly increased the average fruit weight for Sakkoty, Gondaila and Dagana cvs. in both seasons. Method (B) gave the highest fruit weight followed by method (C), while control gave the lowest fruit weight for all cultivars in both seasons. Also, it was noticed that Sakkoty cv. gave the highest fruit weight followed by Gondaila and Dagana cvs. in both seasons, respectively.

In addition, the interaction between cultivars and different hand pollination methods recorded that cultivars Sakkoty, Gondaila and Dagana gave the heaviest fruit weight with method (B) followed by method (C) and control in both seasons, respectively.

Moustafa (1994) and Attalla & Sharraan (1999) obtained similar results on several date cultivars. On the contrary, Moustafa (1985) reported that the different hand pollination methods did not give any significant effect on fruit weight in Seewy date palms.





(1994). On the contrary, Moustafa (1985) reported that the different hand pollination methods did not give any significant effect of fruit flesh weight of Seewy date palms.

#### *Seed weight*

Results tabulated in Table 8 indicated that seed weight was significantly affected by different hand pollination methods for all cultivars under study in both seasons. Method (B) increased seed weight followed by methods (C and A) in both seasons, respectively. Gondaila fruits had the highest seed weight followed by Sakkoty and Dagana fruits in both seasons, respectively.

**TABLE 8. Effect of different hand pollination methods on seed weight (g) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000				Mean	Season 2001			Mean
	Sakkoty	Gondaila	Dagana			Sakkoty	Gondaila	Dagana	
(A) Pollen strands	1.25	1.22	1.02	1.16	1.24	1.22	1.10	1.19	
(B) bestrewing Pollen + flour (3.6g)	1.23	1.37	1.21	1.27	1.23	1.37	1.22	1.27	
(C) Cotton with Pollen + flour (3.6g)	1.20	1.25	1.11	1.19	1.21	1.26	1.15	1.21	
Mean	1.23	1.28	1.11	-	1.23	1.28	1.16	-	

LSI<sup>1</sup> at 5% level for:

Cultivars (A)	Season 2000	Season 2001
Hand pollination methods (B)	= 0.0598	0.0463
A X B	= 0.0691	0.0535
	= 0.1197	0.0927

Regarding to interaction effect, method (B) gave the highest seed weight for Gondaila and Dagana cvs. followed by method (C) and control in both seasons, respectively. The highest Sakkoty cv. seed weight was obtained with control followed by methods (B and C), respectively, in both seasons.

These results are in line with Hussain *et al.* (1985) and on the contrary with Moustafa (1994) who reported that seed weight of Zaghloul and Samani date palm cultivars not affected by all hand pollination treatments during the three experimental seasons.

#### *Chemical characters*

##### *Moisture content percentage*

Data presented in Table 9 showed that fruit moisture content percentage was affected significantly by different hand pollination methods for all cultivars in

both seasons. Method (B) gave the highest fruit moisture content followed by method (C) and control in both seasons, respectively. However, Gondaila cultivar gave the highest fruit moisture content percentage followed by Dagana and Sakkoty in both seasons, respectively.

**TABLE 9. Effect of different hand pollination methods on fruit moisture content (%) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000				Mean	Season 2001			Mean
	Sakkoty	Gondaila	Dagana	Mean		Sakkoty	Gondaila	Dagana	
(A) Pollen strands	19.67	23.00	20.70	21.12	18.53	22.80	22.10	21.14	
(B) bestrewing Pollen + flour (3.6g)	21.63	26.53	22.73	23.63	20.53	26.87	23.17	23.52	
(C) Cotton with Pollen + flour (3.6g)	20.00	25.80	23.43	23.08	19.40	25.17	22.77	22.45	
Mean	20.43	25.11	22.29	-	19.49	24.95	22.68	-	

LSD at 5% level for :

	Season 2000	Season 2001
Cultivars (A)	= 0.6268	0.5565
Hand pollination methods (B)	= 0.7237	0.6426
A X B	= 1.2540	1.1130

According to interaction between methods and cultivars, it was clearly obtained that method (B) gave the highest fruit moisture content with three cultivars under study followed by method (C) and control in both seasons, respectively.

#### *Total soluble solids (TSS) percentage*

Total soluble solids (TSS) percentage of Sakkoty, Gondaila and Dagana fruits was significantly affected by all different hand pollination methods in both seasons (Table 10). Method (C) gave the highest TSS percentage followed by method (B) and control in both seasons, respectively. Regarding to cultivars, Sakkoty fruits were the highest in TSS percentage followed by Gondaila and Dagana in both seasons, respectively.

The interaction between methods and cultivars showed that TSS percentage was the highest with method (C) followed by method (B) and control with Sakkoty cv. in both seasons, respectively. While, Gondaila cv. gave the highest percentage with method (B) followed by method (C) and control in both seasons, respectively. In addition, Dagana cv. gave the highest TSS percentage with method (B) followed by method (C) and control in the first season while it was the highest with method (C) followed by method (B) and control in the second season.

**TABLE 10. Effect of different hand pollination methods on fruit content of TSS (%) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000				Season 2001			
	Sakkoty	Gondaila	Dagana	Mean	Sakkoty	Gondaila	Dagana	Mean
(A) Pollen strands	52.90	51.73	49.70	51.44	52.33	52.07	49.40	51.27
(B) bestrewing Pollen + flour (3.6g)	53.33	57.07	56.60	55.67	52.67	57.30	50.07	53.35
(C) Cotton with Pollen + flour (3.6g)	61.67	55.53	49.87	55.69	63.33	56.17	56.00	58.50
Mean	55.97	54.78	52.06	-	56.11	55.18	51.82	-

LSD at 5 % level for:  
 Cultivars (A) = 0.3491  
 Hand pollination methods (B) = 0.4031  
 A X B = 0.6982

Season 2000  
 = 0.3491  
 = 0.4031  
 = 0.6982

Season 2001  
 = 0.3312  
 = 0.3824  
 = 0.6623

These results are in line with Moustafa (1994) who reported that the traditional pollination gave the lowest value of TSS percentage than all hand pollination methods in Zaghloul and Samani cvs.

#### *Total acidity percentage*

Total fruit acidity percentage was not affected significantly by different hand pollination methods in both seasons for all cultivars under studies (Table 11). Method (B) gave the highest fruit acidity percentage followed by methods (A and C) in the first season. While, control gave the highest total acidity percentage followed by (C and B) methods in the second season. Dagana fruits gave the highest total acidity percentage followed by Sakkoty and Gondaila cvs. in the first season, respectively. While in the second season, Sakkoty fruits had the lowest total acidity percentage than Gondaila and Dagana cvs. which had the same acidity.

**TABLE 11. Effect of different hand pollination methods on fruit acidity (%) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000				Season 2001			
	Sakkoty	Gondaila	Dagana	Mean	Sakkoty	Gondaila	Dagana	Mean
(A) Pollen strands	0.0255	0.0134	0.0268	0.0219	0.0230	0.0269	0.0264	0.0254
(B) bestrewing Pollen + flour (3.6g)	0.0256	0.0213	0.0215	0.0228	0.0252	0.0215	0.0221	0.0229
(C) Cotton with Pollen + flour (3.6g)	0.0201	0.0189	0.0256	0.0215	0.0207	0.0255	0.0253	0.0238
Mean	0.0237	0.0179	0.0246	-	0.0230	0.0246	0.0246	-

LSD at 5 % level for:  
 Cultivars (A) = n.s.  
 Hand pollination methods (B) = n.s.  
 A X B = n.s.

Season 2000  
 = n.s.  
 = n.s.  
 = n.s.

Season 2001  
 = n.s.  
 = n.s.  
 = n.s.

Regarding to interaction, Sakkoty cultivar gave the highest fruit acidity with methods (B, A and C, respectively) in both seasons. Also, Dagana cultivar gave the highest fruit acidity with control treatment followed by methods (C and B, respectively) in both seasons. While Gondaila cultivar gave the highest fruits acidity with method (B) in the first season and with control treatment in the second season.

#### *Total sugars percentage*

Results in Table 12 indicated that fruit content of total sugars percentage was affected significantly by different hand pollination methods used for all cultivars in both seasons. Method (B) gave the highest fruit content of total sugars percentage followed by method (C) and control in the first season, while, method (C) gave the highest percentage in this respect followed by method (B) and control in the second season, respectively. Also, Sakkoty cultivar gave the highest fruit content of total sugars percentage followed by Gondaila and Dagana cultivars in both seasons, respectively.

**TABLE 12. Effect of different hand pollination methods on fruit content of total sugars (% of dry weight) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000			Mean	Season 2001			Mean
	Sakkoty	Gondaila	Dagana		Sakkoty	Gondaila	Dagana	
(A) Pollen strands	70.90	71.93	66.07	69.63	73.27	73.73	66.10	71.03
(B) bestrewing Pollen + flour (3.6g)	89.67	87.70	78.20	85.19	88.23	86.50	66.93	80.55
(C) Cotton with Pollen + flour (3.6g)	90.03	82.57	67.07	79.89	89.93	81.90	77.90	83.24
Mean	83.53	80.73	70.45	-	83.81	80.71	70.31	-

LSD at 5% level for:

	Season 2000	Season 2001
Cultivars (A)	= 0.5686	0.2540
Hand pollination methods (B)	= 0.6565	0.2933
A X B	= 1.1370	0.5080

Regarding to interaction, method (C) gave the highest effect in this regard with Sakkoty cv. followed by method (B) and control in both seasons, respectively. While, Gondaila cv. gave the highest percentage of total sugars content with method (B) followed by method (C) and control in both seasons, respectively. Whereas, Dagana cultivar gave the highest percentage in this respect with method (B) followed by methods (C and A) in the first season, while in the second season, it was the highest with method (C) followed by method (B) and control, respectively.



non-reducing sugars percentage followed by Gondaila and Dagana cultivars in both seasons, respectively.

**TABLE 14. Effect of different hand pollination methods on fruit content of non-reducing sugars (% of dry weight) of some dry date palm cultivars in 2000 and 2001 seasons.**

Hand pollination methods	Season 2000			Mean	Season 2001			Mean
	Sakkoty	Gondaila	Dagana		Sakkoty	Gondaila	Dagana	
(A) Pollen strands	7.70	7.00	1.97	5.56	10.00	8.95	2.92	7.29
(B) bestrewing Pollen + flour (3:6g)	20.11	13.87	3.17	12.38	19.30	11.77	2.77	11.28
(C) Cotton with Pollen + flour (3:6g)	11.93	12.93	2.20	9.02	12.87	12.60	2.97	9.48
Mean	13.25	11.27	2.45	-	14.06	11.11	2.89	-

LSD at 5 % level for :

Cultivars (A)	Season 2000	Season 2001
Hand pollination methods (B)	= 0.6459	0.4893
A X B	= 0.7458	0.5650
	= 1.2920	0.9786

The interaction between hand pollination methods and cultivars observed that method (B) gave the highest fruit content of non-reducing sugars percentage followed by Method (C) and control with three cultivars under study in the first season. While in the second season, Sakkoty cv. gave the highest value with Method (B) followed by methods (C and A); Gondaila cv. with method (C) followed by methods (B and A) and Dagana cv. with method (C) followed by methods (A and B), respectively.

These results are in coincide with Hussain *et al.* (1985) and El-Kassas & Mahmoud (1986) . They reported that total and reducing sugars increased significantly related to method of hand pollination used. While Moustafa (1994) reported that the traditional method increased sugars percentage in both seasons for Zaghloul and Samni cvs. Also, increasing the concentration of pollen grains used in three seasons significantly decreased total sugars and reducing sugars.

The high value of reducing sugars than non-reducing sugars in dry date palm due to convert non-reducing sugars to reducing sugars as affected by heat and invertase enzyme that presented naturally in date palm fruits. Also, sucrose conversion to glucose and fructose with invertase enzyme can be accelerating in present both of water (or fruit moisture content) and heat (Cook & Furr, 1952; Fattah, 1927 and Maier & Metzler, 1961).

In conclusion, different methods of hand pollination were effective on fruit quality and its contents of chemical components of date palm cultivars under study. Method (B) was the best to gave the highest fruit quality than method (C) and control; it may be due to diluting pollen grains which reduced / fruit retained and competition on nutrient, and subsequent raised fruit quality. Also, methods (B and C) may be useful in early flowering female date palm when pollen grains were not available or insufficient of their quantities to complete satisfactory pollination. So method (B) is the best (recommended) for pollinating dry date palm cultivars to increase the fruit quality.

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## تأثير الطرق المختلفة للتلقيح اليدوى على نسبة الثمار المتبقية والمحصول وصفات الثمار فى بعض أصناف نخيل البلح الجاف المصرية

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أجريت هذه الدراسة خلال موسمى ٢٠٠٠ و ٢٠٠١ على بعض أصناف نخيل البلح الجاف المصرية ( السكوتى ، الجنديلة ، الدجنتة ) والمنزرعة فى محطة التجارب الزراعية التابعة لوزارة الزراعة بكم أمبو - محافظة أسوان وذلك لدراسة تأثير ثلاثة طرق مختلفة للتلقيح اليدوى على نسبة الثمار المتبقية عند الجمع وكمية المحصول والصفات الطبيعية والكيميائية لثمار هذه الأصناف وهذه الطرق هى :-

- ١- وضع عدد من الشماريخ الزهرية المذكرة ( عشرة شماريخ) وسط الإغريض المؤنث ( طريقة أ - المقارنة ).
- ٢- تعفير ( نثر ) خليط من حبوب اللقاح والدقيق بنسبة ٢ : ٦ جم على الإغريض المؤنث ( طريقة ب ) باستخدام علبة بودرة التلك .
- ٣- وضع قطعة من القطن مشبعة بمخلوط من حبوب اللقاح والدقيق بنسبة ٢ : ٦ جم داخل الإغريض المؤنث ( طريقة ج ) .

وقد أظهرت النتائج أن النسبة المئوية للثمار المتبقية فى السبابة عند الجمع ووزن السبابة قد زادت مع الطريقة ( أ - المقارنة ) . وكذلك وجد أن صفات الثمار للأصناف الثلاثة من نخيل البلح الجاف قد تأثرت تأثراً مباشراً باختلاف طريقة التلقيح المستخدمة . حيث سجلت الطريقة (ب) أفضل الصفات الطبيعية للثمار من حيث وزن الثمرة ووزن اللحم والحجم وطول وقطر الثمرة وذلك للأصناف الثلاثة السكوتى والجنديلة والدجنتة فى كلا الموسمين .

وكذلك أدت طرق التلقيح اليدوى (ب ، ج ) إلى زيادة صفات الثمار الكيماوية ، حيث زاد محتوى ثمار الأصناف الثلاثة من الرطوبة والمواد الصلبة الذائبة والسكريات الكلية والسكريات المختزلة والغير مختزلة فى كلا الموسمين مقارنة بالطريقة ( أ - المقارنة ).

وبناء على النتائج المتحصل عليها يمكن التوصية باستخدام الطريقة (ب) مع نخيل البلح للأصناف الجافة مثل ( السكوتى والجنديلة والدجنة ) للحصول على أفضل محصول من حيث صفات الجودة العالية ( الطبيعية والكيماوية ) للثمار .