

Effect of some Pollination Treatments on Fruiting of Zaghloul Date Palm Cultivar Under Assiut Climatic Condition.

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Abstract

The effect of spraying pollen grain suspensions as a pollination method of zaghloul date palm which combines with both mechanical pollination and fruit thinning was studied during 2008, 2009 and 2010 seasons. Spraying trail method was conducted by using pollen grains at 1.5 and 3g/L mixed with either boric acid 0.2g/L or ascorbic acid 2g/L plus Egyptian treacle 10% or vinasse 10% as activating media as well as traditional pollination method (control). The obtained results indicated that there are a reduction on the percentage of initial fruit set, fruit retention and bunch weight as the pollen grains suspension concentration is reduced. On the other hand, there was an improve on the fruit quality in term of fruit weight and soluble solid contents (s.s.c) was observed with the reduction of the pollen grain suspension concentrations. Furthermore there were no significant effect between the Egyptian treacle or vinasse as activating media. It could be concluded that using of pollen grains suspension containing 1.5g/L of pollen grains plus either 2g/L ascorbic acid or

0.2g/L boric acid mixed with vinasse 10% lead to obtain a considerable yield with good fruit quality, in addition to the improvement of the efficiency of pollination process.

Key words: Pollen grain, suspensions, boric acid, vinasse, yield, fruit quality, *Phoenix dactylifera*.

Introduction

Date palm is one of the ancient domestic fruit trees in the Middle East countries and their fruits play an important role in the nutritions pattern of many people as well as a strategic crops in food and biochemical industries (Khayyat *et al.*, 2007).

Pollination is one of the major practices to ensure good fruit production. Artificial pollination is considered the major means for commercial date production. Hand pollination becomes a necessary for the successful fruit set and fruiting in most date palm orchards, although it is an expensive practice due to the pattern of palm tree flowering and climbing it several times (Nixon and Carpenter, 1978 and Kotb, 1993).

Pollen grain germination is closely related to both the environmental conditions and stigma

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respectivity. The pollination efficiency and consequently fruit set is highly dependent on these factors. The pollination time, flowering period of male palm, the type of pollen, its viability and amount and the female flowers receptivity are the main factors involved in this process (Brown *et al.*, 1984 and El-Salhy *et al.*, 1997).

The mechanical pollination has a positive effect on the total yield due to increasing the fruit set. It seems to be a viable solution to economize the quantity of pollen and improve the time management of the pollination especially for precocious, later and shorter receptivity cultivars (Haffer *et al.*, 1997 and Al-Wasaibi *et al.*, 2007).

Mixing pollen grains with various carriers and nutrient minerals were beneficial for establishing mechanical pollination, obtaining an economic yield with good fruit quality and enhancing pollination efficiency (Khalil & Al-Shawaan, 1982; El-Mardi *et al.*, 1995; Hussein and Hassan, 2001 and Ragab *et al.*, 2004).

Boron plays an important role in improving the fruit set through encouraging germination and growth of pollen grains. It has significantly increased the yield and fruit quality of date palm (Khayyat *et al.*, 2007 and El-Salhy *et al.*, 2007).

Egyptian treacle and sucrose have a positive effect on fruit setting, yield and fruit quality. Using pollen grains plus boric acid with either Egyptian treacle

or sucrose improved the yield and fruit quality of Zaghloul and Samani dates (Ashour *et al.*, 2004 and El-Salhy *et al.*, 2007).

Moreover, using suspension of pollen grains either alone or mixed with ascorbic acid was successful in pollination and improved the pollination process efficiency of some palm cultivars (Alabri *et al.*, 2006 and Al-Sabahi *et al.*, 2006 and El-Salhy *et al.*, 2010).

This study aimed to innovating an untraditional method in date palm pollination which combined both mechanical pollination and fruit thinning effects, in addition to get high yield with good fruit quality.

Materials and Methods

This study was conducted at Experimental fruit Orchard, Department of Horticulture, Faculty of Agriculture, Assiut University, Assiut, Egypt, during three successive growing seasons 2008, 2009 and 2010, on 34 years old Zaghloul date palm cultivar.

Eight date palms that are uniform in vigour and in good physical condition, free of insect damage and diseases were selected. The number of spathes per palm were adjusted to nine by removing excess earliest, latest and smallest inflorescences for achieving the following nine treatments:

T1- 1.5 (g/L) pollen + 0.2g boric acid + 10% Egyptian treacle.

T2- 1.5 (g /L) pollen + 0.2g boric acid + 10%vinasse.

T3- 1.5(g /L)pollen + 2g ascorbic acid + 10% Egyptian treacle.

T4- 1.5 (g /L) pollen + 2g ascorbic acid + 10% vinasse.

T5- 3 (g /L) pollen + 0.2g boric acid + 10% Egyptian treacle.

T6- 3 (g/L) pollen + 0.2g boric acid + 10% vinasse.

T7- 3 (g/L) pollen + 2g ascorbic acid + 10% Egyptian treacle.

T8- 3 (g/L) pollen + 2 ascorbic acid + 10% vinasse.

T9- Hand pollination by inserting 10 strands/bunch (traditional).

These treatments were applied on each palm. Pollination was uniformed in respect of the source and method to avoid residues of metaxenia. The experiment was set up in a complete randomized block design with nine replications of one bunch each.

Hand pollination as well as pollination treatment sprays were applied at the forth day of spathe cracking. Sprays of pollen suspensions are thoroughly applied to the bunch by small hand-

sprayer (1/2 liter capacity) at the amount of 50 ml/bunch. To prevent the mixed pollination, after the spraying of pollen suspension, every bunch was bagged by paper bags which is removed after four weeks.

Data concerning the temperature (C°), relative humidity (%) and wind Speed during the pollination periods of the present study are given in Table (1). They were obtained from meteorological station located at the Horticultural orchard of Assiut University.

1 – Fruit set %:

Initial fruit set and fruit retention percentages were evaluated one month after of pollination and at harvest time, respectively. Five female strands per bunch were randomly selected from each replication. The number of fruit set was recorded and then fruit set percentage or fruit retention were calculated as the following equation:

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

$$\text{Fruit retention \%} = \frac{\text{Number of retained fruits}}{\text{Number of retained fruits} + \text{Number of flower scars}} \times 100$$

2 – Yield and fruit quality:

The bunches were evaluated at the harvest time and fruit weight/bunch (kg) was recorded. Fifteen fruits from each bunch were randomly picked for determining the following physical and chemical fruit characters:

1. Fruit and seed weight

(in g), of then pulp percentage was calculated

2. Fruit length (L) and diameter (D) were measured by vernier caliper (in cm).

3. Percentages of total soluble solids contents by the hand refractometer.

Table (1): Temperature (°C) , relative humidity (%) and wind speed at Assiut region during pollination periods of "Zaghloul" date palms in 2008, 2009 and 2010.

		2008				2009				2010			
		Temperature (°C)		R-humidity (%)	Wind speed	Temperature (°C)		R-humidity (%)	Wind speed	Temperature (°C)		R-humidity (%)	Wind speed
		min	max			min	max			min	max		
10	Mar.	16	26	59	12	8.2	24.8	49.5	6	19	37.4	48	5
11	Mar.	12.4	25.8	57	9	9.2	17.2	44.5	6	19.6	36.6	48.5	6
12	Mar.	10.8	26.8	50.5	9	9.4	25.2	53.5	7	18.2	36.6	44.5	6
13	Mar.	10.8	24.2	59	11	9.4	25.6	53	9	17.2	36.6	43	4
14	Mar.	9.4	26.6	58	7	8.8	22.4	52.5	8	20	35.6	52	6
15	Mar.	10	30	54	6	8	24.2	49.5	6	22	38	48	7
16	Mar.	10	27.4	60	7	8.6	23.6	51	8	16.6	28	51.5	11
17	Mar.	10.2	27.6	54.5	7	6.8	24.4	50	8	14.8	24.4	51.5	8
18	Mar.	10.8	28.4	56.5	8	7.8	24	50.5	5	11.4	22.2	54	9
19	Mar.	11.2	33.6	49	5	8	31.4	47	3	9.4	23.4	50	10
20	Mar.	13	33.6	46.5	5	16	34.2	35.5	7	9	24	50.5	9
21	Mar.	13.6	36.6	44	3	10.6	24.2	48	7	9.6	27.8	51.5	4
22	Mar.	15	37.4	38	3	8	27.2	43.5	4	11	26.8	54	9
23	Mar.	14	26.2	34.5	7	10	29.6	55.5	10	12.8	26.2	59	7
24	Mar.	15.2	41	33	5	9.6	22	47	6	12	26.4	59	6
25	Mar.	15	41	38	5	8	24	50	4	11.4	29.2	49	8
26	Mar.	14.2	27.6	45	10	8.2	25.4	46.5	6	12.2	24.4	58.5	8
27	Mar.	10.8	27.8	42	8	7.6	27.4	48	7	10.8	24.8	65	6
28	Mar.	11	32.6	53.5	11	9	23.2	52.5	7	11	29.2	55.5	4
29	Mar.	14.4	29.2	41.5	7	8.4	25.4	48	6	14.2	29.2	49.5	6
30	Mar.	13	24	56	10	8.2	27.8	47.5	6	12	27.2	52.5	6
31	Mar.	10.8	24.8	59	12	9.6	27.2	51.5	6	10.8	30.4	44.5	5
1	April	9.8	26	53.5	9	12	29.6	44.5	5	10.4	34.8	48	5
2	April	9.8	28.6	55.5	6	13.2	28.4	43	7	14.4	39.8	43	2
3	April	9.6	31	48.5	7	12.8	30.2	48.5	8	16.4	38.2	41.5	6
4	April	12.2	27.6	59.5	7	12.4	32.4	48.5	4	17.4	36.6	48	6
5	April	11.2	31.6	49	5	15.6	34.2	48.5	8	15.2	30.2	54.5	7
6	April	13	34.6	44.5	10	18.8	30.4	51	6	14.2	30	58	6
7	April	13.8	26.4	44.5	11	16.6	31	45	7	15	28.2	49	7
8	April	10.8	26.8	50.5	11	13	28.8	46.5	8	13.2	28	49	7

Source : Assiut Meteorological authority station.

4.Total titratable acidity % was determined as citric acid by titration with 0.1 NaoH using phenol phthaline as an indicator (A.O.A.C., 1985).

5.Percentage of total and reducing sugars by using volumetric method that outlined in A.O.A.C. (1985) by Lane and Eynon.

All the obtained data were tabulated and subjected to the proper statistical analysis of variance using L.S.D. test for recognizing the significance differences among the various treatment means according to the method outlined by Snedecor and Cochran (1980) and Gomez and Gomez (1984).

Results and Discussion

Yield Index

Fruit weight/bunch is an indicator for the yield of palm trees since the number of bunches on the palm was constant.

Table (2) exhibit the effect of pollination treatments on the initial fruit set, fruit retention and bunch weight of Zaghoul date palm in 2008, 2009 and 2010 seasons. It is obvious from the data that the results took similar trend during the three studied seasons. Data proved that fruit set and fruit retention were significantly decreased due to pollination by using suspension of pollen grains either of 1.5 or 3.0 g/L with boric acid or ascorbic acid along with either Egyptian treacle or vinasse compared with traditional pollination (T9). The fruit retention percentage were (28.86, 27.10, 26.33, 26.23,

29.70, 30.31, 31.23, 30.42 and 35.01% as an average of the three studied seasons) due to pollinate by spraying pollen grains suspension at 1.5 g pollen + 0.2 g boric acid + 10% Egyptian treacle/L (T1), 1.5 g pollen + 0.2 g boric acid + 10% vinasse/L (T2), 1.5 g pollen + 2 g ascorbic acid + 10% Egyptian treacle (T3), 1.5 g pollen + 2 g ascorbic acid + 10% vinasse (T4), 3 g pollen + 0.2 g boric acid + 10% Egyptian treacle (T5), 3 g pollen + 0.2 g boric acid + 10% vinasse (T6), 3 g pollen + 2 g ascorbic acid + 10% Egyptian treacle (T7), 3 g pollen + 2 g ascorbic acid + 10% vinasse (T8) and traditional hand pollination, control (T9), respectively. The corresponding fruit weight/bunch were (9.8, 9.97, 10.24, 10.32, 11.66, 11.25, 11.33, 10.95 and 12.76) due to using T1 to T9, respectively.

The reduction on fruit weight/bunch was associated with decreasing the pollen grain suspension concentration from 3 to 1.5 g. These results could be attributed to the reduction of fruit set as decreasing the pollen grain suspension concentration as well as reduce the fruit retention, hence, the fruit weight/ bunch was shortage.

The results indicated that there are insignificant differences in fruit weight/ bunch due to pollination by using 3 g pollen compared with traditional hand pollination. On the other hand, data concerning the effect of using either boric acid or ascorbic acid,

Table (2): Effect of different pollen grain concentrations mixed with boric acid or ascorbic acid and either with Egyptian treacle or vinasse on yield components of Zaghoul date palm cultivar during 2008, 2009 and 2010 seasons.

Characteristics. Treat. Year	Initial fruit set%				Fruit retention%				Fruit weight/ bunch (Kg)			
	2008	2009	2010	Mean	2008	2009	2010	Mean	2008	2009	2010	Mean
1.5(g/L) pollen +0.2g boric acid+10% Egyptian treacle T ₁	48.70	54.10	55.73	52.84	28.68	29.08	28.83	28.86	8.40	9.50	11.50	9.80
1.5(g /L) pollen +0.2g boric acid+10%vinasse T ₂	46.15	52.10	53.60	50.62	26.13	28.18	27.00	27.10	8.50	9.60	11.80	9.97
1.5(g /L) pollen +20g ascorbic acid+10% Egyptian treacle T ₃	46.53	51.30	53.48	50.43	25.50	27.25	26.25	26.33	9.00	10.13	11.60	10.24
1.5 (g /L) pollen +20g ascorbic acid+ 10%vinasse T ₄	45.50	49.80	51.40	48.9	26.03	26.80	25.85	26.23	8.80	10.35	11.80	10.32
3(g /L) pollen +0.2g boric acid+ 10%Egyptian trea- cle T ₅	52.90	55.90	56.05	54.95	28.68	29.38	31.05	29.70	10.10	11.50	13.38	11.66
3 (g/L) pollen +0.2g boric acid+10%vinasse T ₆	50.90	53.90	54.80	53.2	30.03	30.68	30.23	30.31	9.75	11.00	13.00	11.25
3(g/L) pollen +20g ascorbic acid+ 10%Egyptian trea- cle T ₇	53.50	55.18	57.63	55.44	30.15	32.4	31.15	31.23	9.75	11.15	13.10	11.33
3 (g/L) pollen +20 ascorbic acid+10%vinasse T ₈	52.00	54.70	55.83	54.18	29.52	32.7	29.03	30.42	9.25	10.80	12.80	10.95
Hand pollination (traditional) T ₉	58.10	59.23	61.83	59.72	33.46	36.82	34.75	35.01	11.90	12.63	13.75	12.76
L.S.D. 5%	3.52	2.83	3.8	4.00	2.88	3.10	3.35	3.25	2.25	2.15	1.92	2.11

as well as, Egyptian treacle or vinasse, show that insignificant differences in initial fruit set, fruit retention and fruit weight/bunch due to pollination by using pollen grains suspension.

These findings could be attributed to the sucrose solution which affect in increasing moisture absorption around the flower, then the pollen grains can be easily directed towards the flowers and drift is minimized. Boron was encouraged the germination and growth of pollen grains as well as movement of sugars and fungi control (El-Salhy *et al.*, 2007).

Fruit quality:

Data in Table (3) indicated that there was an improvement of the fruit physical quality in terms of increasing the fruit weight and dimensions by using a pollen grains suspension compared to the traditional pollination (control). The improving of these traits was associated with the decrease of the used pollen grains suspension concentration from 3 to 1.5 g/L. The heaviest fruit were detected on palms pollinated with pollen grain suspension concentration at 1.5 g + 2 g ascorbic acid + 10% vinasse (T4). No significant differences in fruit weight and dimension were observed due to using either boric acid or ascorbic acid, as well as either between Egyptian treacle or vinasse used.

The recorded fruit weight were (25.03, 25.23, 25.63, 26.83,

23.91, 24.33, 25.10, 25.50 and 21.04 g as an average of the three studied seasons) due to T1 to T9 respectively. The increment percentage of fruit weight in response to different pollination treatments over control (T9) were (18.96, 19.91, 21.82, 25.95, 13.64, 15.64, 20.76 and 21.20% as an average of the three studied seasons) due to T1 to T8 respectively

Such improvement of fruit physical properties i.e. increasing fruit weight and size might be occurred in response to use diluted pollen grains suspension plus either boric acid or ascorbic acid along with either 10% Egyptian treacle or 10% vinasse for pollination. These findings could be due to the reduction on fruit set cause a shortage in the number of fruits per bunch without changing the number of leaves that may induce the better supply of carbohydrates that are synthesised in the leaves. Such effects were similar to fruit thinning effects on improving the physical fruit properties. So, it could be easily to identify the initial fruit set percentage which gave the considerable yield characterized by high fruit quality using either different hand pollination or fruit thinning methods.

In addition, ascorbic acid protective tissues from oxidation and has a positive action on enhancing the division of cells and biosynthesis of carbohydrates (Elade (1992). Vinasse contains high level of organic matter,

potassium, calcium and moderate amount of nitrogen and phosphorus (Gomezzy and Rodriguez, 2000) that activate the photosynthesis, synthesis of total carbohydrates and proteins which enhances cell division and enlargement leading to increase the fruit weight and size.

Data in Table (4) indicated that pollination by pollen grains suspension was significantly improved the fruit chemical constituents in terms of increasing the soluble solids and sugar contents and reduction of total acidity percentage compared to pollination by traditional pollination. The improvement of these fruit traits was associated with the reduction of pollen grain suspension concentration from 3 to 1.5 g/L. Using pollen grain suspension at 1.5 g plus both 2 g ascorbic acid and 10% vinasse gave the maximum values of soluble solids and sugar contents, whereas, using traditional hand pollination gave the minimum values.

These findings might be due to a reduction in the fruit set percentage by using the diluted pollen grain suspension. Such reduction in fruit setting was effective on lowering the competition among the fruits and induce an adequate carbohydrates and other essential foods for the residual ones consequently enhance the fruit maturity and improve its contents of total soluble solids and sugar contents. So, it could be said that the use of diluted

pollen grain suspension has a similar effect like the fruit thinning on improving the fruit quality (El-Salhy *et al.*, 2010 and El-Sese *et al.*, 2010). In addition, the improvement of fruit chemical quality due to vinasse might be ascribed to its role as potassium and other nutrient sources, consequently enhancing photosynthesis activity and production of sugars that translocate to the fruit.

These results were supported by the results of Ashour *et al.* (2004), Al-Sabahi *et al.* (2006) and Alabri *et al.* (2006) who recommended that the use of 0.5 g pollen grains/liter of H₂O concentration to pollinate Ford and Jabree date palm and 0.1 g pollen grains/liter of H₂O for Helaly Oman date palm to get an economic yield with good fruit quality. Moreover, El-Salhy *et al.* (2010) concluded that pollination of Saigy date palm using pollen grain suspension concentration at 2.5 g/L plus 1 g ascorbic acid was sufficient to get a high yield with good fruit quality.

On the light at previously results, it could be concluded that pollination of Zaghoul date palm using pollen grain suspension concentrations at 1.5 g/L plus 2 g ascorbic acid along with 10% vinasse was sufficient to get a high yield with good fruit quality. The advantages of such pollination method reduces the labors and duration of pollination. It does not require a highly trained labors as with the

Traditional technique. It ensures the possibility of pollinating a palm at several times in a short period of time. Moreover, allowing the use of mixture of pollens originating from different sources, thus ensuring good fertilization, and eliminating the risk of accidents occurring as with the old method of climbing a palm several meters high. In addition using vinasse as activation material improve the pollination efficiency and decrease the cost pollination process and environmental pollution which could be occurred by excess of industrial wastes.

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تأثير بعض معاملات التلقيح علي الإثمار في نخيل البلح الزغول
تحت ظروف أسبوت المناخية
عبدالفتاح مصطفى الصالحي ، رأفت أحمد علي مصطفى ، محمد جمال الدين
محمد عبد الله

قسم البساتين - كلية الزراعة - جامعة أسيوط

تمت دراسة تأثير الرش بمعلق حبوب اللقاح علي تلقيح نخيل البلح الزغول المنزرعة بمزرعة كلية الزراعة جامعة أسيوط - مصر خلال مواسم ٢٠٠٨ ، ٢٠٠٩ ، ٢٠١٠. وذلك كوسيلة تجمع بين التلقيح الميكانيكي وخف الثمار. حيث أجري التلقيح برش معلق حبوب اللقاح بتركيزي ١,٦ - ٣ جم / لتر مختلطة مع ٠,٢ جم حمض يوريك أو ٢ جم حمض الأسكوربيك بالإضافة إلي ١٠% العسل الأسود أو ١٠% فيناس مقارنة بالتلقيح اليدوي (المعاملة التقليدية). وقد أظهرت النتائج :

- حدوث نقص جوهري في نسبة عقد الثمار والثمار الباقية ووزن السوباطة نتيجة نقص حبوب اللقاح بمعلق التلقيح.
- ارتبط نقص نسبة عقد الثمار وزن السوباطة بزيادة معنوية في الصفات الطبيعية والكيميائية للثمار.

من نتائج الدراسة يمكن التوصيه باستخدام معلق حبوب اللقاح بتركيز ١,٥ جم / لتر + ٢ جم حمض الأسكوربيك أو ٠,٢ جم حمض البوريك بالإضافة إلي ١٠% فيناس حيث يؤدي ذلك إلي إنتاج محصول جيد ذو خصائص ثمرية عالية بالإضافة الي تحسين كفاءة عملية التلقيح ونقص التلوث البيئي الناشئ عن مخلفات صناعة السكر.