

(Original Article)



Effect of Pollinator Strands Number on Fruit Set, Bunch Weight and Fruit Quality of “Sewy” Date Palm

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Abstract

Pollination is important process for date palm in terms of their influence on fruit development, quality and yield, as well as the organization's yearly tree bearing. The development of pollination technology, which results in a reasonable level of fruit set with the use of a small number of pollen grains, is necessary to improve the productivity of date palms, especially in arid conditions. This experiment was done on Sewy date palm for both progressive seasons 2020 and 2021 at Pomology department's farm, Assiut Governorate, Egypt. The influence of strand number on fruit Physico-chemical properties was tested. Seven levels of pollination were applied as 2, 4, 6,8,10 and 12 strands/ inflorescences.

The results illustrated that the initial and final fruit set percentages, bunch weight and final crop/palm increased significantly by increasing pollination levels in both experimental seasons by treatment of 14 strands/inflorescence compared to the check treatment (8 strands/inflorescence), whereas; fruit, seed and pulp weight; TSS, acidity and sugars content decreased significantly by the same treatment (except for acidity in the 1st season and non-reducing sugars in the 2nd season).

Hence, it could be concluded that pollination with 14 male strands should be possible to gain an inclusive yield and quality and increase the efficiency of the pollination process of Sewy date palms.

Keywords: *Inflorescences, Pollination density, Phoenix dactylifera.*

Introduction

Date palm (*Phoenix dactylifera* L.) is A monosexual dioecious and monocotyledonous palm (Zhao *et al.*, 2012). It is one of the most crops to grow within the arid lands of most countries of the center East and geographical area and affects the high proportion of the economies of those countries (FAO, 2012).

Recently, Egypt could be a standout amongst the foremost vital countries within the world industry of palm. As *Phoenix dactylifera* is a dioecious crop, the pollination method is assumed by wind or insects, resulting in minimal quality

fruits. Therefore, to get a commercial crop, hand pollination techniques should be used (Ghnam and Al Muhtaseb, 2006, El-Salhy *et al.*, 2010).

The foremost imperative yield of date development could be a consequence of a high fruit set. The action of this rate depends on a mix of some variables, for example, the standard of the pollen grain supply, the potency of the fertilization method, the period of the fertilization method, the compatibility of males and females, and environmental conditions like temperature, irrigation, soil, and fertilization (El-Salhy *et al.*, 2012 and Iqbal *et al.*, 2012).

Ever after, the date palm is a dioecious plant, pollen has to be imparted from the male to the female palm, this could happen naturally by the wind. However, this requires an equal number of male and female palms in the farm, which makes date cultivation uneconomical. Therefore, commercial date production entails artificial pollination which ensures good fertilization and overcomes the disadvantages of dioecy and also reduces the number of male palms. Hand or manual pollination is considered an ancient practice in date palm farming, which is usually carried out by dusting or enrollment 2 or 3 dry male strands between the strands of female spathe (Sial 1980, Khataab 1985 and Hamood *et al.*, 1986).

As far as we can tell, informations about the optimum pollination density that improves fruit set and quality of "Sewy" date palm are mingy. Thus, this research was executed to study the effect of different pollination levels on fruit quality of "Sewy" date palm in comparison with the farmer's applied level (8 strands/inflorescence) to reveal the optimum pollination level for this cultivar.

An experiment executed by Awad (2007) issued that there were no significant effects for pollination density either on fruit set or on fruit quality. These results confirm those of Haffar *et al.* (1997) who found that neither pollen concentration nor the recurrence of application on 'Khalas' date palm cultivar by mechanistic dusting influenced fruit set and final yield.

The present study was executed to estimate different pollination levels and their potential responses to yield and fruit quality for certain physicochemical properties of Sewy date palm.

Materials and Methods

Experiment site

The current experiment was conducted during two progressive seasons of 2020 and 2021 on Sewy date palm cultivar grown on the research farm of Pomology department, faculty of agriculture, Assiut, Egypt.

Plant Materials

Ten healthy female "Sewy" date palms 15 years old were selected and 7 spathes were left for each female. Each treatment was represented by 1 bunch/palm. The bunch/leaf ratio was 8:1 for all replicates. The pollination was carried out after 2 - 4 days from spathe opening using one male date palm (Meghal) as a source of pollen in both seasons. All female spathes were bagged in paper bags

directly after pollination. They remained covered for approximately two weeks to prevent natural pollination by wind, bee pollination, and/or unwanted pollen from the surrounding treatments.

Treatment Categories were

- 1- T1 (2 male strands / female bunch)
- 2- T2 (4 male strands / female bunch)
- 3- T3 (6 male strands / female bunch)
- 4- T4, control (8 male strands / female bunch, which is the farmer's used level of pollination.)
- 5- T5 (10 male strands / female bunch)
- 6- T6 (12 male strands / female bunch)
- 7- T7 (14 male strands / female bunch)

Fruit physical characters

Fruit set

A month after pollination, ten female strands/ bunch were chosen at random and fruits number was registered, then the fruit set percentage was calculated according to El-Mkhtoun (1982). All bunches were harvested on the first week of October at the peak of color development in both experimental seasons.

$$\text{Fruit set (\%)} = \frac{\text{Number of fruits setting on the strands}}{\text{Total number of flowers/strand}} \times 100$$

The total yield/palm (kg) was evaluated at the harvest time and the fruit weight/bunch (kg) was recorded.

Fruit height and diameter were measured by a Vernier caliper, so the fruit shape (L/D) was then calculated.

Total soluble solids (TSS %) were gauged by hand refractometer.

Total acidity and sugars content was measured according to A.O.A.C. (1990).

Statistical analysis

Experimental design was RCBD with ten replicates. Data analysis was done according to Steel and Torrie (1980). Means were compared according to the Least Significant Differences (LSD) test at 5% level of the probability.

Results and discussion

Fruit set

Initial and final fruit set percentages increased significantly with increasing strands number used for pollination (Table 1). The highest level of pollination (14 strands/inflorescence –T7) recorded the highest fruit set percentage (78.62, 76.84 and 68.75, 67.37 %) compared to the check treatment (69.65, 67.54 and 58.00, 56.29%) in both seasons, respectively.

Table 1. Effect of strands number on some physical properties of “Sewy” cultivar during 2020 and 2021 seasons

Treatments	Initial fruit set (%)		Final fruit set (%)		bunch weight (kg)		Final crop (kg/palm)		Fruit weight (g)		Seed weight (g)		Pulp weight (g)		L/D	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
T1	38.89	33.14	26.36	24.38	10.13	8.85	31.60	29.45	22.3	23.14	3.90	4.07	18.40	19.07	4.83	5.08
T2	52.94	49.46	41.99	39.59	12.83	12.30	41.89	40.23	21.1	21.72	3.53	3.93	17.57	17.79	4.65	4.92
T3	61.62	58.91	44.90	47.56	14.16	13.68	48.65	47.81	19.77	19.77	3.27	3.74	16.50	16.03	4.46	4.75
T4	69.65	67.54	58.00	56.29	15.20	14.70	53.28	53.75	18.97	18.93	3.60	3.88	15.37	15.05	4.22	4.80
T5	73.48	73.65	61.60	60.37	16.30	15.55	56.14	57.79	18.36	18	3.03	3.72	15.33	14.28	3.96	4.13
T6	76.89	74.80	64.19	63.50	16.50	15.95	56.85	58.52	17.37	17.29	2.80	3.55	14.57	13.74	3.81	4.0
T7	78.62	76.84	68.75	67.37	16.85	16.10	58.41	59.11	15.87	16.41	2.90	2.83	12.97	13.58	3.68	3.92
L.S.D at 5%	3.56	4.26	3.09	2.52	0.76	0.68	2.87	2.31	1.31	1.23	0.45	0.24	0.97	0.67	0.26	0.23

T1: 2 strands/inflorescence, T2: 4 strands/inflorescence, T3: 6 strands/inflorescence, T4 (control): 8 strands/inflorescence, T5: 10 strands/inflorescence, T6: 12 strands/inflorescence and T7: 14 strands/inflorescence.

Bunch weight

Bunch weight is considered as an index for the yield and reflects the best favorable treatments. Table 1 shows that bunch weight increased significantly from T4 (control) to T7 and declined by decreasing pollination level to record lower values for the control treatment (16.85, 16.10 and 15.20, 14.70 kg), respectively with significant differences between them.

T7 recorded the highest yield final weight compared to the control (58.41, 59.11 and 53.28, 53.75 kg/palm) in both seasons, respectively, with significant differences between them.

Fruit physical characters

Data in Table 1 viewed that T7 recorded the lowest values of fruit and pulp weight compared to the control (15.87, 16.41 and 18.97, 18.93 g. for fruit weight) and (12.97, 13.58 and 15.37, 15.05 for pulp weight) in both seasons, respectively, with significant differences between them.

Whereas there was no significant variation between T7 and control in terms of seed weight, where it recorded, also, the lowest values of seed weight (2.90, 2.83 and 3.60, 3.88 g) compared to the control in both seasons, respectively,

Although T7 recorded a higher fruit set percentage than all other treatments, fruit weight was lower, this may be attributed to fruit drop as a result of excessive fruit set under this treatment. These results are in agreement with those reported by Mawlood (1980), El-Kassas (1983), Ghalib *et al.* (1987) and Mostafa (1994) on different date palm cultivars. They found that there is a positive correlation between fruit set percentage obtained and bunch weight at harvest.

So, there were significant differences among all treatments compared to the control in terms of physical properties (fruit, seed and pulp weight) during the study period.

Our data, in this path, disagreed with the results found by by El Mardi *et al.*, (2007), Aljuburi (1995) Shabana *et al.* (1985) who established that pollination method had insignificant variations in some physical properties of Khalas and Khasab cultivar.

Table 2. Effect of strands number on some chemical properties of "Sewy" cultivar during 2020 and 2021 seasons

Treatments	TSS (%)		Acidity (%)		Total sugars (%)		Reducing sugars (%)		Non-reducing sugars (%)	
	2020	2021	2020	2021	2020	2021	2020	2021	2020	2021
T1	40.20	40.40	0.222	0.234	32.16	32.14	20.07	19.18	12.09	12.96
T2	39.60	40.00	0.209	0.222	30.74	31.81	19.23	19.69	11.51	12.12
T3	39.20	39.60	0.201	0.218	29.85	30.92	18.80	18.91	11.05	12.01
T4	38.40	39.20	0.192	0.209	29.53	30.32	18.75	18.86	10.78	11.46
T5	38.00	38.60	0.188	0.204	28.80	30.08	18.53	19.00	10.27	11.08
T6	37.60	38.00	0.187	0.196	28.13	29.38	18.13	18.58	10.00	10.80
T7	37.20	37.80	0.183	0.188	27.57	28.84	17.93	18.31	9.64	10.53
L.S.D at 0.05 %	1.18	0.96	0.02	0.011	0.64	0.55	0.64	0.61	0.35	0.41

T1: 2 strands/inflorescence, T2: 4 strands/inflorescence, T3: 6 strands/inflorescence, T4 (control): 8 strands/inflorescence, T5: 10 strands/inflorescence, T6: 12 strands/inflorescence and T7: 14 strands/inflorescence.

Fruit chemical properties

Data in (Table 2) shows that fruit TSS decreased significantly with increasing pollination levels from 2 strands (recorded 40.20 and 40.40 %) to 14 strands/inflorescence (recorded 37.20 and 37.80 %) passing by the control treatment (recorded 38.40 and 39.20 %) during the two seasons, respectively.

Total acidity decreased insignificantly in the first season (0.183 %) and the second season (0.188 %) indicating a significant decrease compared to the check treatment that recorded (0.192 and 0.209 %), respectively, during the two seasons.

As well, total, reducing and non-reducing sugars behave on the same track as the abovementioned properties, where increasing strands number to 14 strands/inflorescence led to a significant decrease in total sugars (27.57 and 28.84 %) compared to the control treatment (29.53 and 30.32 %) during the two seasons, respectively.

In contrast, for reducing sugars, increasing strands number to 14 strands/inflorescence resulted in a significant decrease in reducing sugars in the 1st season (17.93 and 18.31 %) compared to the control treatment (18.75 and 18.86 %) respectively, where there was an insignificant decrease in the 2nd season.

Likewise, in terms of non-reducing sugars, increasing strands number to 14 strands/inflorescence led to a significant decrease in non-reducing sugars (9.64 and 10.53 %) compared to the control treatment (10.78 and 11.46 %) during the two seasons, respectively. These changes in fruit quality are associated with changes in some promoters and enzymes (Mardi 1995 and El Mardi *et al.*, 2007).

The above results indicate that among different pollination levels, T7 showed the highest bunch weight and fruit quality in both seasons. Thus, it is recommended that 14 strands/inflorescence is the optimum pollination density for "Sewy" date palm under Assiut conditions.

References

- Aljuburi, H.J. (1995). Effect of mechanical and hand pollination on fruiting characteristics and productivity of date palm (*Phoenix dactylifera* L.) fard cultivar. King Saudi University J. Agricultural Sciences (1) 7: 97-116.
- Association of Official Agricultural Chemicals (A.O.A.C.), (1990). Official Methods of Analysis of the A.O.A.C., 15th Ed. Published by A.O.A.C. Washington D.C., USA.
- Awad, M.A. (2007). Fruit Set Failure in Tissue Culture-Derived Date Palm Trees (*Phoenix dactylifera* L.) cv. 'Nabt Saif' as Affected by Pollinator Type and Pollination Density. *Acta Horticulturae*, 736:441-448
- El-Kassas, Sh.E. (1983). Manual bunch and chemical thinning of Zaghoul dates. *Assiut J. Agric. Sci.* 14 (2): 221-233.
- El Mardi, M.O; Al Said, F.A.; Sakit, C.B.; Al Kharusi, L.M.; Al Rahbi, I.N. and Al Mahrazi, K. (2007). Effect of pollination method, fertilizer and mulch treatments on the physical and chemical characteristics of date palm (*Phoenix dactylifera* L.) fruit 1: Physical characteristics. *Acta Hort.* (ISHS) 736: 317-328.
- El-Mkhtoun, F.M.B. (1982). Effect of different pollen types on fruiting and fruit quality in some date varieties. M.Sc. Thesis, Dept. Hort., Fac. Agric., Al-Azhar Univ., Egypt.
- El-Salhy, A., Abdel-Galil, H.A., El-Bana, A.A. and Ahmed, E.F. (2010). Effect of pollen grains suspensions spraying on yield and fruit quality of Saidy date palm cultivar. *Acta Horti.* 882: 329-336.
- El-Salhy, A.M., Mostafa, R.A.A., El-Banna, A.A. and Diab, Y.M. (2012). Effect of pollination methods and pollen grains dilution on bunch weight and fruit quality of Sewy date palm cultivar. *Assiut J. Agric. Sci.*, 43, 2: 119-131.
- Food and Agriculture Organization "FAO" (2012). Food and Agriculture Organization Statistical Yearbook, FAO. Rome Italy.
- Ghalib, H.H; Mawlood, A.; Abbass, M.J. and Abd-elislam, S. (1987). Effect of different pollinators on fruit set and yield of Sayer and Hallawy date palm cultivars under Basrah conditions. *Date palm J.* 5 (5): 155-173.
- Ghnaim, H.D. and Al-Muhtaseb, J.A. (2006). Effect of pollen source on yield, quality and maturity of "Mejhool" date palm. *Jordan Journal of Agricultural Sciences* 2: 8-15.
- Haffar I, Al-Jubri, H. and Ahmed, M.H. (1997). Effect of pollination frequency and pollen concentration on yield and fruit characteristics of mechanically pollinated date palm tree (*Phoenix dactylifera* L.) var Khalas. *J. Agri. Engg. Res.*, 68(1), 11-14
- Iqbal, M., Niamatullah, M. and Munir, M. (2012). Effect of various *Dactylifera* males pollinizer on pomological traits and economical yield index of cv's Shakri, Zahidi and Dhakki date palm (*Phoenix dactylifera* L.). *J. Anim Plant Sci.* 22: 376-383.
- Mardi, A. (1995). Effect of pollination and pollen dilution on some chemical constituent of Farad dates in different stages of fruit development. *Hort. Abst.* (60); 12-361-10874.
- Mawlood, E.A. (1980). Physiological studies on fruit development of Samani and Zaghoul date palm cultivars. Ph.D. Thesis, Fac. Agric., Cairo Univ., Egypt.

- Mostafa, A.A.R. (1994). Effect of different pollination methods on improving productivity of certain date palm (*Phoenix dactylifera* L.) cultivars under Assuit conditions. Ph.D. Thesis, Fac. Agric., Assuit Univ., Egypt.
- Shabana, H.R. Mawlood, E.A and Khalil, Th. (1985). Date palm mechanical pollination report. Agric. Res. Water Resources Center Sci. Res. Council, Baghdad. Iraq.
- Steel, R.G., and Torrie, J.H. (1980). Principles and procedures of statistics 2 nd Ed. Mc. Graw Hill Book Company, New York, USA pp. 183-193.
- Zhao, Y., Williams, R., Prakash, C.S. and He, G. (2012). Identification and characterization of gene-based SSR markers in date palm (*Phoenix dactylifera* L.). BMC Plant Biol 12: 237.

تأثير عدد شماريخ الملقح على عقد الثمار، وزن السويطة وجودة ثمار نخيل البلح السيوي

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الملخص

أجريت هذه الدراسة خلال موسمي 2021 و2020 بمزرعة الفاكهة، كلية الزراعة، جامعة أسيوط بهدف دراسة تأثير مستويات مختلفة من التلقيح على محصول وجودة ثمار البلح السيوي مقارنة بمستوى التلقيح لدى مزارعي أسيوط. تم اختيار 10 نخلات وترك 7 أغاريض على كل نخلة، وذلك لإجراء 7 مستويات مختلفة من التلقيح وهي: 2 شمراخ / اغريض، 4 شمرايخ / اغريض، 6 شمرايخ / اغريض، 8 شمرايخ / اغريض، 10 شمرايخ / اغريض، 12 شمراخ / اغريض و14 شمراخ / اغريض في كلا الموسمين.

اظهرت النتائج وجود زيادة معنوية في نسبة العقد الابتدائي والنهائي، وزن السويطة ووزن المحصول النهائي / نخلة عند استخدام 14 شمراخ / اغريض مقارنة بالكنترول (8 شمرايخ / اغريض)، بينما حدث نقص معنوي في وزن الثمرة، وزن البذرة، وزن اللب، معامل شكل الثمرة، المواد الصلبة الذائبة في الثمار، حموضة العصير (النقص غير معنوي في الموسم الاول)، نسبة السكريات الكلية والمختزلة وغير المختزلة (النقص غير معنوي في الموسم الثاني) باستخدام نفس المعاملة مقارنة بالكنترول. وعليه يمكن التوصية باستخدام 14 شمراخ / اغريض لتلقيح نخيل البلح السيوي لتحسين العقد وجودة الثمار تحت ظروف أسيوط.