Assiut J. Agric. Sci., 52 (2) 2021 (60-69) *ISSN: 1110-0486*
Website:www.aun.edu.eg/faculty_agriculture/journals_issues_form.php *E-mail: ajas@aun.edu.eg*

Effect of Pollination Methods on Yield and Fruit Quality of Barhy Date Palm under Aswan Conditions

El-Salhy, A.M.[1]; A.A. B. Masoud[1]; Doaa S.E. El-Kassas[1]; Ezz G. Gadalla[2] and Hafez K.Hassan[2]

[1]Pomology Dept., Fac. Agric., Assiut University, Assiut, Egypt
[2]Central Laboratory for Date Palm Research and Development, Agriculture Research Center Giza, Egypt.

Accepted for publication on: 10/6/2021

Abstract

Pollination is a critical process in date palms production series that affect yield and fruit quality. This study aimed to evaluate the effect of different pollination methods (spray pollen grain with zinc, boric or ascorbic acid solution) on yield and fruit quality of Barhy date palm. This study was conducted at Kom Ombo, Aswan Governorate, Egypt during 2019 and 2020 seasons.

Results showed that most beneficial treatment in this concern is spraying female spathes with 0.5 to 1 g pollen grains plus 1 g zinc or ascorbic acid/L water which gave economical yield with good fruit quality. Moreover, it distinguished to save time, effort, labor, cost and more practical to it is a promising technique in the future.

Keywords: *Barhy date palm, pollen grain, suspension, pollination, thinning, fruit quality.*

Introduction

Date palm is a dioecious, perennial, diploid and mono-cotyledon plant (Zhao *et al*., 2012). It is one of the main crops to grow in arid land of most countries of the Middle East and North Africa and affects the high proportion of the economics of these countries (FAO, 2016).

Egypt is considered among the top ten date producers. Zaghloul, Samany, Hayany are the most economically important date palm cultivars grown in Egypt. Date palm is grown in Egypt in both Nile Valley, and desert districts. The total area and number of females reached 117073 feddans and 14379648 palms. The produced yield reached 1465030 tons Table (1), according to M.A.L.R. (2019).

Since the date palm is a dioecious crop, the pollination process is carried out by wind or insects, which in turn leads to low quality fruit. Therefore, to obtain a commercial production, artificial pollination methods must be used (El-Salhy *et al*., 2010 and Shaaban *et al*. 2019). The most imperative yield of date development is a consequence of high fruit set percentage. The achievement of this rate relies upon a blend of a few variables, i.e. the quality of the pollen source, the pollination efficiency process, the compatibility of males and females as well as environmental conditions, irrigation, soil and fertilization (El-Salhy *et al*., 2012 and Iqbal *et al*., 2012).

Building up a pollination procedure and change from the traditional method of pollination to strategy pollinated by pollen grain-water suspension spray prompted improve the fruit set is perfect degree without thinning

process has likewise improved the fruit quality. The utilization of the technique to pollinate with pollen suspension with water reduce labor effort and costs of thinning process (El-Salhy *et al*., 2010; Samauni-Mona *et al*., 2016; Shaaban *et al*., 2019 and El-Shorabasy *et al*., 2020).

Mixing pollen grains with various carriers, nutrient minerals and ascorbic acid were beneficial in establishing mechanical pollination and obtaining an economical yield with good fruit quality. Also, it is responsible for enhancing pollination efficiency (Awad, 2011; Abdalla *et al*., 2011; El-Salhy *et al*., 2012; Ahmed, 2014; Al-Wasfy, 2014; Samouni-Mona *et al*., 216; Shaaban *et al*., 2019 and El-Shorabasy *et al*., 2020).

So, the present study was done to assess various methods for pollination effects on fruiting of Barhy date palm under Aswan conditions.

Materials and Methods

The experiment was carried out during two successive growing seasons 2019 and 2020 on 20 years old Barhy date palms. The selected palms were grown in Research farm in Agricultural research station that located at Kom Ombo, Aswan Governorate, Egypt. The laboratory work was conducted in Regional Agricultural Research Station of Aswan. The texture of the soil is silty clay.

Ten healthy palms nearly similar in growth vigour were selected. Regular agricultural practices were carried out as usual. The leaf/bunch ratio was adjusted at the end of the blooming season to meet their value of 8:1. Artificial pollination was uniformly performed in respect of source, date and method. The numbers of spathes per palm were adjusted to 10 for achieving of the following ten treatments:

1- Spraying pollen grain suspension 2 g pollen/L plus ascorbic acid at 1000 ppm.
2- Spraying pollen grain suspension 2 g pollen/L plus boric acid at 1000 ppm.
3- Spraying pollen grain suspension 2 g pollen/L plus zinc at 1000 ppm.
4- Spraying pollen grain suspension 1 g pollen/L plus ascorbic acid at 1000 ppm.
5- Spraying pollen grain suspension 1 g pollen/L plus boric acid at 1000 ppm.
6- Spraying pollen grain suspension 1 g pollen/L plus zinc at 1000 ppm.
7- Spraying pollen grain suspension 0.5 g pollen/L plus ascorbic acid at 1000 ppm.
8- Spraying pollen grain suspension 0.5 g pollen/L plus boric acid at 1000 ppm.
9- Spraying pollen grain suspension 0.5 g pollen/L plus zinc at 1000 ppm.
10- Hand pollination by inserting 8-10 strands/spathe (traditional hand method)

These treatments were applied on the same palm. Pollination was uniformed in respect of source and method to avoid residues of metaxenia.

The design of the experiment was completely randomized design with ten replicates, one spathe per each.

Hand pollination as well as pollination treatments spray was applied at third day of spathe cracking.

Sprays of pollen suspension are thoroughly applied to the spathe by small hand sprayer (½ liter capacity) at the amount of 100 ml/spathe. To prevent contamination of pollens, after the spraying of pollen grain suspension, every spathe was bagged by paper bags which are removed after four weeks.

Data concerning the temperature (°C) and relative humidity (%) during the pollination periods and fruit growth of the present study are given in Table (1).

Table 1. Average temperature and average relative humidity in Aswan region during 2019 and 2020 seasons.

	2019		2020	
	Temperature (°C)	**Humidity (%)**	**Temperature (°C)**	**Humidity (%)**
Feb.	21	28	19	33
March	24	20	25	26
April	30	15	29	21
May	37	10	34	18
June	39	15	37	15
July	38	16	37	17
August	38	19	38	19
Sept.	35	21	38	18
October	33	25	33	22

The following parameters were determined to evaluate the effects of different pollination methods on fruiting.

Yield components and fruit quality:

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

$$\text{Fruit set (\%)} = \frac{\text{No. of fruit setting on the strand}}{\text{Total number of flower per strand}} \times 100$$

$$\text{Fruit retention (\%)} = \frac{\text{Number of retained fruits on the strand}}{\text{Number of retained fruit} + \text{Number of flowers scars}} \times 100$$

At the harvest time, bunches of each palm were picked and weighed, and then the yield/palm (kg) was recorded.

Sample of 50 fruits were taken randomly from each replicate to determine some physical and chemical properties.

These characteristics included determination of fruit weight, fruit dimension, flesh percentage and fruit moisture percentage as well as TSS, sugar content, tannins and total acidity as outlined in A.O.A.C. (1995).

All the obtained data were tabulated and analyzed to the proper statistical analysis according to Gomez and Gomez (1984) and Snedecor and Cochran (1990). The differences between treatment means were compared by Duncan's multiple range tests at 5% level of probability to Duncan (1955).

Results

1- Yield components:

Data illustrated in Tables (2 & 3) showed the effect of spraying pollen grains suspension at different concentration (0.5 to 2 g/L) with boric acid zinc or ascorbic acid (1000

ppm) on fruit set, fruit retention percentages and bunch weight of Barhy date palm during 2019 and 2020 seasons. It is worth to mention that the fruit set, fruit retention percentages and bunch weight reacted almost similarly in the two studied seasons.

Fruit set, fruit retention percentages and bunch weight were significantly affected by different pollination methods during the two studied seasons. There are insignificant differences in fruit set and fruit retention percentages as well as bunch weight due to pollination by using either pollen grains suspension at 1 g or 0.5 g plus ascorbic acid or zinc compared with traditional hand pollination. On other hand, pollination by pollen grains suspension at 2 g/L plus ascorbic acid or zinc at 1000 ppm significantly increased these traits and had the highest values compared to traditional hand pollination method.

Table 2. Effect of different pollination methods on yield components of Barhy date palm during 2019 and 2020 seasons.

Charact. / Treat.		Initiation fruit set			Fruit retention %		
		2019	2020	M	2019	2020	M
Spraying suspension of male 2 g pollen/L plus ascorbic acid at 1000 ppm.	T_1	31.28 A	39.65 A	35.47	23.15 A	30.51 A	26.83
Spraying suspension of male 2 g pollen/L plus boric acid at 1000 ppm.	T_2	29.33 B	37.15 B	33.24	21.43 B	28.50 B	24.97
Spraying suspension of male 2 g pollen/L plus zinc at 1000 ppm.	T_3	31.0 AB	39.33 A	35.17	23.0 AB	30.10AB	26.55
Spraying suspension of male 1 g pollen/L plus ascorbic acid at 1000 ppm.	T_4	27.81 B	34.78 B	31.30	20.18 B	26.34 C	23.26
Spraying suspension of male 1 g pollen/L plus boric acid at 1000 ppm.	T_5	25.95CD	31.98 C	28.97	18.93 C	24.85 C	21.89
Spraying suspension of male 1 g pollen/L plus zinc at 1000 ppm.	T_6	27.40 C	33.65 C	30.53	19.95 B	25.90 C	22.93
Spraying suspension of male 0.5 g pollen/L plus ascorbic acid at 1000 ppm.	T_7	27.11CD	33.98 C	30.55	19.88 B	26.11 C	23.00
Spraying suspension of male 0.5 g pollen/L plus boric acid at 1000 ppm.	T_8	25.58 D	32.12 C	28.85	18.60 C	24.73 C	21.67
Spraying suspension of male 0.5 g pollen/L plus zinc at 1000 ppm.	T9	26.51CD	33.65 C	30.08	19.55 C	25.95 C	22.75
Hand pollination by inserting 8-10 strands/spathe (traditional hand method)	T_{10}	28.43BC	36.59 B	32.51	21.12 BC	27.10BC	24.11

Table 3. Effect of different pollination methods on bunch weight (kg), fruit weight, flesh % and fruit length of Barhy date palm during 2019 and 2020 seasons.

Charact. / Treat.	Bunch weight (kg)			Fruit weight			Flesh %			Fruit length(cm)		
	2019	2020	M	2019	2020	M	2019	2020	M	2019	2020	M
T1	11.40 A	13.30 A	12.35	17.16 BC	17.58 B	17.37	93.90 A	93.81 A	93.86	3.57 AB	3.72 AB	3.65
T2	10.30 B	11.90 B	11.10	17.95 B	17.45 B	17.70	93.83 A	94.15 A	93.99	3.40 B	3.52 B	3.46
T3	10.90 A	12.80 A	11.85	17.41 BC	19.21 B	17.31	93.63A	94.30 A	93.97	3.51 B	3.64 AB	3.58
T4	10.10 B	11.30 BC	10.70	19.65 A	18.96 A	19.31	92.87 AB	94.10 A	93.49	3.62 AB	3.75 AB	3.69
T5	9.50 BC	10.90 C	10.20	19.40 A	19.38 A	19.39	93.63 A	93.80 A	93.72	3.63 AB	3.71 AB	3.67
T6	9.80BC	11.80 B	10.80	19.15 A	19.36 A	19.26	92.43 AB	93.26 AB	92.85	3.52 AB	3.67 AB	3.60
T7	9.50 BC	10.90 C	10.20	18.70 AB	18.41 AB	18.56	93.33 A	94.10 A	93.72	3.48 B	3.63 B	3.56
T8	9.20 C	10.60 C	9.90	19.30 A	18.85 A	19.09	92.88 AB	94.18 A	93.53	3.54 AB	3.66 AB	3.60
T9	9.40 C	11.00 C	10.20	18.85 AB	18.93 A	18.89	93.23 A	93.30 AB	93.27	3.50 B	3.64 AB	3.57
T10	9.90 BC	11.70 BC	10.80	16.78 C	17.35 B	17.07	90.13 B	90.56 B	90.35	3.21 C	3.34 C	3.28

As adding ascorbic acid, boric acid or zinc to pollen grain suspension, data show that ascorbic acid is the more effective followed by zinc. There are no significant differences due to use ascorbic acid or boric acid. On other side, the boric acid had a least effect compared to ascorbic acid.

In this respect, it seems that the reduction in fruit set percentage and bunch weight could be explained as a result of decrease in pollen grain concentration in suspension. These findings emphasized that there is a positive correlation between the pollen grain amount and initial fruit set percentage.

Moreover, pollination using pollen grain suspension (1 or 0.5 g) failed to induce any significant effect on fruit bunch weight compared with traditional hand pollination. Whereas, the bunch weight significantly increased as response of pollen grain suspension (2 g/L) plus 1000 ascorbic acid or 2 g/L plus 1000 ppm zinc compared with traditional hand pollination (control).

The obtained bunch weight was (12.35, 11.10, 11.85, 10.70, 10.20, 10.80, 10.20, 9.90, 10.20 and 10.80 kg as an av. the two studied seasons) due to pollinate by spraying pollen grains suspension at 2 g pollen + 1000 ppm ascorbic acid (T_1), 2 g pollen + 1000 ppm boric acid (T_2), 2 g pollen + 1000 ppm zinc (T_3), 1 g pollen + 1000 ppm ascorbic acid (T_4), 1 g pollen + 1000 ppm boric acid (T_5), 1 g pollen + 1000 ppm zinc (T_6), 0.5 g pollen + 1000 ppm ascorbic acid (T_7), 0.5 g pollen + 1000 ppm boric acid (T_8), 0.5 g pollen + 1000 ppm zinc (T_9) and traditional pollination method (T_{10}), respectively. Hence the increment percentage of bunch weight attained (14.39, 1.85 and 9.72% as an av. the two studied seasons) due to T_1, T_2, T_3 compared to T_{10}, respectively.

Thus, it could be concluded that there is a reduction on bunch weight with reducing the pollen grain suspension concentration where reduction on bunch weight was associated with decreasing the pollen grain suspension.

Fruit quality:

1- Physical fruit properties:

Data presented in Tables (3 & 4) show the effect of spraying pollen grains suspension with ascorbic acid, boric acid and zinc at different con-

centration on physical fruit properties of Barhy date palm during 2019 and 2020 seasons. It is obvious from the Data that results took a similar trend during the two studied seasons. It was noticed that there was a positive relationship between both improving the fruit physical characteristics in terms of increasing fruit weight, fruit dimension and flesh percentage in one side and pollination by using a dilution pollen grains suspension in the other side compared with traditional hand pollination (control). The improving on these characteristics was associated with decreasing the used pollen grain suspension concentration from (2 g/L to 0.5 g/L) plus ascorbic acid or zinc.

Moreover, there was an increasing on the fruit weight recorded with reducing the used pollen grain suspension concentration. Such increment was significantly increased with using pollen grain suspension at concentration at 1 or 0.5 g/L compared to control. The heaviest fruit were detected on plants pollinated with pollen grain suspension concentration at 1 g plus boric acid. The recorded fruit weights were (17.37, 17.70, 17.31, 19.31, 19.39, 19.26, 18.56, 19.08, 18.89 and 17.07 g as an av. of the two studied seasons) due to T_1 to T_{10}, respectively. Hence, the increment percentage of fruit weight due to use pollen grain suspension over control were attained (1.75, 3.69, 1.41, 13.12, 13.59, 12.83, 8.73, 11.78 & 10.66 as an av. of the two studied seasons) due to T_1 to T_9 compared to T_{10}, respectively. No significant differences in fruit weight were observed due to use pollen grain suspension concentration namely 1.0 or 0.5 g pollen grain/L.

2- Fruit chemical constituents:

It is evident from data in Tables (4 & 5) that the pollination by dilution pollen grain suspension concentrations at 1 to 0.5 g/L significantly improved the fruit chemical constituents in terms of increasing the total soluble solids and sugar contents and reduction the moisture content percentage, total acidity and tannins content compared to pollination by traditional hand pollination. The improving of these fruit traits was associated with reduction of pollen grain suspension concentrations from 2 to 0.5 g/L.

Using dilution pollen grain suspension under 2 g/L significantly increased total soluble solids and sugar contents compared to traditional hand pollination method.

Table 4. Effect of different pollination methods on fruit diameter (cm), moisture, TSS and total sugars Barhy dates during 2019 and 2020 seasons.

Charact.	Fruit diameter			Moisture%			TSS			Total Sugar %		
Treat.	2019	2020	M	2019	2020	M	2019	2020	M	2019	2020	M
T1	3.15 A	3.11 A	3.13	50.90 B	50.30 B	50.60	44.20 D	45.00 C	44.6	40.50 D	40.10 D	40.30
T2	2.99 B	3.01 B	3.00	49.80 B	49.30 BC	49.55	45.20 D	46.10 C	45.65	41.40 D	41.10 D	41.25
T3	3.14 A	3.11 AB	3.13	46.90 C	47.80 C	47.35	48.30 C	47.80 B	48.05	44.30 C	42.60 C	43.45
T4	3.14 A	3.09 AB	3.12	50.20 B	49.60 B	49.90	45.40 D	45.70 C	45.55	41.50 D	40.60 D	41.05
T5	3.11 A	3.11 AB	3.11	45.60 CD	47.20 C	46.40	49.90 B	48.20 B	49.05	45.70 B	42.80 C	44.25
T6	3.07 AB	3.08 AB	3.08	44.10 D	44.50 D	44.30	51.40 AB	51.00 AB	51.2	46.90 A	45.40 AB	46.15
T7	3.12 A	3.10 AB	3.11	46.50 C	45.60 D	46.05	49.10 BC	49.80 B	49.45	44.60 C	44.40 B	44.50
T8	3.11 A	3.11 A	3.11	44.80 D	44.60 D	44.70	50.80 AB	50.70 AB	50.75	46.30 AB	45.60 A	45.95
T9	3.08 AB	3.06 AB	3.07	43.60 D	43.60 E	43.60	51.80 A	51.90 A	51.85	47.30 A	46.50 A	46.90
T10	2.81 C	2.83 C	2.82	53.80 A	52.50 A	53.15	41.30 E	42.70 D	42	37.80 E	38.40 E	38.10

Table 5. Effect of different pollination methods on some fruit chemical constituents of Barhy date palm during 2019 and 2020 seasons.

	Reducing%			Non reducing			Tannins %			Acidity %		
	2019	2020	M	2019	2020	M	2019	2020	M	2019	2020	M
T1	30.50 D	29.20 D	29.85	10.00 D	10.90 DE	10.45	0.18 B	0.14 B	0.16	0.32 B	0.25 B	0.28
T2	31.10 D	29.90 D	30.50	10.30 D	11.20 D	10.75	0.17 B	0.13 C	0.15	0.31 B	0.24 C	0.27
T3	33.40 C	31.10 C	32.25	10.90 C	11.50 CD	11.2	0.16 D	0.12 D	0.14	0.28 C	0.23 D	0.25
T4	31.30 D	29.60 D	30.45	10.20 D	11.00 D	10.6	0.16 CD	0.13 CD	0.14	0.29 C	0.24 CD	0.26
T5	34.60 B	31.30 C	32.95	11.20 B	11.60 C	11.4	0.14 EF	0.11 F	0.13	0.25 D	0.20 EF	0.23
T6	35.40 AB	33.10 AB	34.25	11.50 AB	12.30 AB	11.9	0.14 F	0.11 F	0.12	0.24 E	0.20 EF	0.22
T7	33.70 BC	32.30 B	33.00	11.80 A	12.10 B	11.95	0.15 E	0.12 EF	0.13	0.26 D	0.21 E	0.24
T8	34.90 AB	33.20 AB	34.05	11.40 B	12.50 A	11.95	0.14 F	0.11 F	0.12	0.24 E	0.20 F	0.22
T9	35.60 A	33.90 A	34.75	11.70 AB	12.60 A	12.15	0.13 F	0.11 EF	0.12	0.24 E	0.20 EF	0.22
T10	28.40 E	27.90 E	28.15	9.30 E	10.60 E	9.95	0.20 A	0.18 A	0.19	0.36 A	0.33 A	0.34

The recorded total soluble solids were (44.60, 45.65, 48.05, 45.55, 49.05, 51.20, 49.45, 50.75, 51.85 & 42.00% as an av. of the two studied seasons) due to T_1 to T_{10}, respectively. Hence the increment percentage of total soluble solids attained (6.19, 8.69, 14.40, 8.45, 16.79, 21.90, 17.74, 20.83 & 23.95%) due to T_1 to T_9 compared to T_{10}, respectively.

On the other hand, data in Table (4 & 5) showed that using dilution pollen grain suspension at 2, 1 or 0.5 g/L significantly reduced the moisture and tannins contents as well total acidity compared to use traditional hand pollination.

The improvement of these fruit traits was associated with the reduction of pollen grain suspension concentration from 2 to 1.0 or 0.5 g/L. Using pollen grain suspension at 0.5 g plus 1000 ppm zinc the highest values of total soluble solids and sugar contents and lowest values of moisture and tannin contents likewise total acidity, whereas using traditional hand pollination gave the minimum values of total soluble solids and sugar contents and highest values of moisture and tannin contents and total acidity.

So it could be said that the using dilution pollen grain suspension similar the fruit thinning effects on improving fruit quality.

Discussion

Pollination is considered the most important difficult and expensive practice to ensure good yield in date palms. The limited quantity of pollen grains was the basis to justify the use of mechanical pollination by sprayers and dusters. The positive action of using pollen with carriers on yield and fruit quality was mainly attributed to their important role in enhancing the efficiency of pollination and fertilization. The mechanical pollination requires mixing the pollen grains with a bulky material to minimize the amount needed of pollen grains. This bulky material must be available, cheap, and with specific gravity close to that of the pollen grains in order to obtain homogeneous mixture (Alabri *et al*., 2006; El-Salhy *et al*., 2010; Abdalla *et al*., 2011 and Awad, 2011).

These finding might be due to reduction the fruit set percentage since using dilution pollen grain suspension. Such reduction in fruit setting was effectively on lowered the

competition occurred between fruits induce an adequate carbohydrates and other essentials food for left ones and consequently increased the fruit weight and enhanced the fruit maturity and improve its content of total soluble solids and sugar contents. Such effects were similar the fruit thinning effects in improving the physical fruit properties. So, it could be easily to identify the initial fruit set which gave the appropriate yield with good fruit quality using either different pollination methods or fruit thinning.

The protective of ascorbic acid on tissues from oxidation as well as the positive action of it on enhancing the diversion of cells and biosynthesis of carbohydrates could explain the present results (Elade, 1992). In addition, boron encourages the germination and growth of pollen grains as well as movement of sugars and controls the fungi (El-Salhy *et al*., 2007).

These findings were supported by the results of (Ashour *et al*., 2004; Al-Sabahi *et al*., 2006; Alabri *et al*., 2006; El-Salhy *et al*., 2010 and Al-Wasfy 2014) who remanded that using the combining pollen grains with boric acid, ascorbic acid or zinc suspension as spray for date palms pollination. Such pollination method increased the yield and improved fruit physical and chemical properties.

Conclusion

On the light of previous results, it could be concluded that using of pollen grains suspension containing 0.5 to 1 g/L plus 1000 ppm ascorbic acid, boric acid or zinc lead to obtain a considerable yield with good fruit quality.

References

Abdalla, M.G.; A.M. El-Salhy and R.A.A. Mostafa (2011). Effect of some pollination treatments on fruiting of Zaghloul date palm cultivar under Assiut climatic condition. Assiut J. Agric. Sci., 42: 350-362.

Ahmed, E.F.S. (2014). Increasing pollination efficiency in Saidy date palms using starch carrier along with pollens suspension. Proceeding of the 5th International Date Palm Conference, Abu Dhabi, UAE, March 16-18, p. 237-243.

Alabri, N.; K. Al-Busaidi and S. Alhemaimee (2006). Effect of pollen grains suspension on fruit set and physicochemical characteristics of two date palm (*Phoenix dactylifera*.) cultivar Qnt. Conf. on date palm production and processing technology Muscat, Oman, May 9-11, P 19.

Al-Sabahi, S.; K. Al-Busaidi; S. Al-Amree and S. Al-Abri (2006). Effect of pollen grains suspension on fruit set and yield of date palm (*Phoenix dactylifera*) cultivar Fard. Conf. on date palm production and processing technology, Muscat, Oman, May 9-11, p 18.

Al-Wasfy. M.M.M. (2014). Yield and fruit quality of Zaghloul date palm in relation to using new technique of pollination. Stem Cell, 5, 1: 14-17.

Ashour, N.E.; H.S.A. Hassan and E.A.M. Mostafa. (2004). Yield and fruit quality of Zaghloul and Samany date palm (*Phoenix dactylifera* L.) as affected by pollination methods Annals Agric. Sci. Ain Sham Univ., Cairo, 49 (2): 631-642.

A.O.A.C. (1995). 'Association of Official analytical chemists. Official methods of analysis, 16th Ed.'

AOAC International, Washington, D.C., USA.

Awad, M.A. (2011). Pollination of date palm (*Phoenix dactylifera* L. Lulu) with pollen grains water suspension. Met., Env. & Arid Land Agric. Sci., 22, (1): 91-99.

Duncan, D.B. (1955). Moldable rang and moldable F-test. Biometrics. 11: 1-24.

Elade, Y. (1992). The use of antioxidants for control gray mould (*Botrytic cinera)* and white mould (*Seierotinia scietotiorum)* in various crops. Plant Pathol., 141: 417- 426

El-Salhy, A., H.M. Marzouk; H.A. Abdel-Galil and E.A. Mahmoud (2007). Effect of some pollination treatments in yield and fruit quality of some date palm cultivars. The 4th symposium on date palm in Saudi Arabia King Faisal Univ., Al-Hassa, 5-8 May.

El-Salhy, A.; H.A. Abdel-Galil; A.A. El-Bana and E.F. Ahmed (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.; R.A.A. Mostafa; A.A. El-Banna and Y.M. Diab (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.

El-Sharabasy, S.F.; Tahany.Saber and Ghazzawy, H.S. (2020). Response of barhee date palm cultivar to different pollination methods. Plant Archives 20. (2): 4001-4006.

FAO (2016). Food and Agriculture Organization .'Quarterly Bulletin of Statistics' 6 No. 113-32 yearbook Annual 12 Prod. 48: 155-157.

Gomez, K.A. and A.A. Gomez (1984). Statistical Procedures for Agriculture Research. 2nd Ed. John Wily and Sons, New York130 p.

Iqbal, M., M. Niamatullah and M. Munir (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.

M.A.L.R. (2019). Ministry of Agriculture and Land Reclamation Publishers Economic Affair Sector Bull., Agric. Statistics, Egypt.

Samouni-Mona, T.M.; A.M. El-Salhy; Ibtesam F.M. Badawy and E.F. Ahmed (2016). Effect of Pollination and Thinning Methods on Yield and Fruit Quality of Saidy Date Palms. Assiut J. Agric. Sci., 47, (3): 92-103.

Shaaban, M.M.; E.F.S. Ahmed and M.M. El-Akkad (2019). Studies on the Improvement of Date Palm Productivity Using Different Methods of Pollination and Fruit Thinning Levels. J. Plant Production, Mansoura Univ.,. 10, (4): 373 – 377.

Snedecor, G.W. and W.G. Cochran, (1990). Statistical Methods 7th ed. Iowa State Univ. Press. Ames.

Zhao, Y., R. Williams, C.S. Prakash and G. He (2012). Identification and characterization of gene-based SSR markers in date palm (*Phoenix dactylifera* L.). BMC Plant Biol 12: 237.

تأثير طرق التلقيح علي المحصول وجودة ثمار نخيل البلح البرحى تحت ظروف أسوان

عبدالفتاح مصطفى الصالحى[١]، علاء عبد الجابر بدوي مسعود [١]، دعاء شحاته العزب القصاص[١]، عز الدين جاد الله جاد الله[٢]، حافظ خليل حسن خليل[٢]

[١]قسم الفاكهة – كلية الزراعة – جامعة أسيوط – أسيوط ، مصر
[٢]المعمل المركزي للأبحاث وتطويل نخيل البلح – مركز البحوث الزراعية – مصر

الملخص

تعتبر عملية التلقيح من العمليات البستانية الضرورية ذات التأثير المباشر على نمو الثمار وجودتها وكذلك إنتاجية نخيل البلح. ويعد تطوير عمليات التلقيح التى من شأنها الحصول على نسبة عقد مرتفعة مع جودة عالية للثمار دون الحاجة لاستخدام كميات كبيرة من حبوب اللقاح أمراً ضرورياً وفعالاً لتحسين إنتاجية نخيل البلح. ولذا أجريت هذه الدراسة خلال موسمى ٢٠١٩ و٢٠٢٠ على نخيل البلح البرحى النامية بالمزرعة البحثية لمحطة البحوث الزراعية في كوم أمبو – أسوان – مصر حيث تضمنت الدراسة التلقيح رشاً بمعلق مائى يحتوى على ٠,٥ إلى ٢,١ جم حبوب اللقاح بالإضافة إلى ١ جم من الزنك – البورون أو حمض الأسكوربيك.

وقد أظهرت النتائج أن التلقيح بمعلق من ٠,٥ – ١ جم حبوب لقاح بالإضافة إلى ١ جم من الزنك أو حمض الأسكوربيك أدت إلى نقص نسبة العقد والعقد النهائى مع زيادة وزن الثمار وتحسين جودتها مقارنة بالتلقيح اليدوى العادى. وعليه تعتبر هذه الطريقة جيدة لإنتاج محصول عال ذو خصائص ثمرية جيدة فضلاً عن تقليل كمية حبوب اللقاح المستخدمة كما أنها عملية تجمع بين التلقيح والخف حيث تقلل من تكلفة الإنتاج وتحسين كفاءة التلقيح وخصائص الثمار.