



Effect of Pollination Time and Hours of Day Time on Fruit Set and Production of Seewy Date Palm Cultivar in El Dakhla Oasis New Valley Governorate

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ABSTRACT

This study was conducted during two successive seasons (2021& 2022) on Seewy date palm cultivar growing in El Dakhla Oasis New Valley Governorate to investigate the influence of pollination following spathe cracking and hours of day time on fruit set and production of Seewy date palm, three times after spathe cracking (two, three and four days) were choice, and three pollination times during day (7am, 12pm and 5 pm) were used, the obtained results showed that the earlier pollination after two days from spathe cracking increased fruit set percentage and total yield with low quality of fruits, while delaying pollination to four days from spathe splitting gave lower fruit set percentage and lesser yield with high quality of fruits, on the other hand the highest fruit set percentage and total yield were obtained with pollination performed at time (5pm) or before sun set followed by (12am) and (7am) in descending order, from the foregoing results it's noticed that under El Dakhla Oasis New Valley Governorate condition, the highest yield per bunch was obtained when pollination carried out two days after spathe cracking with time at (5pm) or before sun set, while the lowest yield per bunch was obtained when pollination performed the fourth day after spathe cracking at time (7am).

Keywords: Date palm, pollination, spathe cracking, fruit set, total yield

INTRODUCTION

Date palm tree (*Phoenix dactylifera*) is an old common fruit trees in many countries all over the world. because it could be established in a wide range of soil and environmental conditions. Iraq, Iran, Saudi Arabia, Algeria and Egypt are the leading countries in date palm cultivation and production (FAO, 2005). Date palm has great economic importance and agricultural uses throughout human history. In Egypt, distribution of date palm covers a large area extends from Aswan to north Delta, beside the Oasis of Siwa, Baharya, Farafra, Kharga and Dakhla (Abd El- Azim & Merie, 1961). The variation in the ecological range has their influence on the characteristics of both the trees and fruit quality. Date palms are grown well in the new reclaimed Land under different soil conditions. Among all the Egyptian governorates, New Valley Governorate ranked the fourth position after Sharkia, Beharia, and Aswan according to the acreage and the number of females (Abd El- Azim & Merie, 1961). There are three main types of dates based on fruit moisture content, i.e., soft, semi dry, and dry cultivar. Seewy date palm is one of the most important CV. of semi dry dates grown in Egypt especially New Valley Governorate. Hand pollination is the most expensive operation due to climbing several times according to the pattern of flowering for the palms (Al Baker, 1972; Hussein, 1982; Hussein et al., 1979). Observations indicated the need of date palms grown in orchards to intensive pollination several times to cover the long following season and to ensure good fruit set (Al Baker, 1972; Hussein et al., 1979; Shaheen, 1986).

Artificial pollination is considered the only way for commercial date palm production (Kadri et al., 2019; Othmani et al., 2020). Determination of length time or selecting the best time during which the female flowers of different date palm cultivars remain respective to Fertilization is very important to date growers. Early pollination after flowers opening is very beneficial for obtaining female flowers very receptive to Fertilization.

Pollination the palms after five days of spathe cracking is considered the maximum length of receptivity to obtain appropriate yield of good fruit quality (Ahmed & El-Shaikh, 1971; Al Baker, 1972; Hussein, 1982; Hussein et al., 1979)

Thus, this study was conducted to assess the period of time pollination, which the female flowers of Seewy date palm remain respective to Fertilization for suggesting the best time for pollination of Seewy date palm. and the proper day time of pollination after female spathe cracking which results in appropriate production quantitatively and qualitatively.

MATERIALS and METHODS

This study was carried out during two successive seasons of 2021 and 2022 on Seewy date palms (*Phoenix dactylifera*) of about 20 years old grown in a sandy clay soil at a private orchard in El Dakhla Oasis New Valley Governorate, Egypt. the selected palms were uniform in vigor, healthy, good physical condition, Free of insects, damage and diseases. they are planted at 8×8 meters apart. the number of female spathes per each palm was adjusted to nine spathes by removing the excess earliest, latest and small bunches. the leaf bunch ratio was maintained at 8:1 (Hussein et al., 1979; Shaheen, 1986).

Hand pollination of all selected palms was achieved by inserting five male strands into the center of female spathes using the same sources of pollen grains. All bunches were bagged after pollination to prevent contamination of pollens. The selected palms were received the same horticultural practices. This experimental included two factors (A, B), the first factor (A) involved three treatments from daytime pollination (7am, 12 and 5 pm) while the second factor (B) consisted of three treatments from dates of pollination after spathe cracking (two, three and four days) therefore, the experiment included 27 different pollination treatment, Each treatment was represented by three Seewy date palms (each one by replicate). All fruit bunches were harvested at late rutab stage (the last week of September). bunch

weight (kg) was recorded yield per palm (kg) was estimated by multiplying number of bunches by average bunch weight. Thirty fruits from each bunch were picked at random for determination the physical and chemical fruit characteristics fruit weight (g), fruit dimensions length and width (cm), percentage of total soluble solids by using hand refract meter. The percentages of total, reducing and non-reducing sugars were determined according to (Lane & Eynon, 1923) volumetric method, non-reducing sugars percentage was computed by calculated the differences between total sugars and non-reducing sugars. total acidity was determined. the obtained data were tabulated and subjected to the proper statistical analysis of variance using New LSD test for recognizing the significance differences among the various treatment means according to the methods outlined by (Snedecor & Cochran, 1972) and (Gomez & Gomez, 1984).

RESULTS AND DISCUSSION

1-Fruit set %: Data regarding the effect of pollination Time after spathe cracking and hours of daytime pollination on fruit set% is shown in table (1).

1-1"Effect of pollination time after spathe cracking on fruit set %: Fruit set% decrease with delaying pollination following spathe cracking, delaying pollination to fourth days after spathe opening significantly reduced the percentage of fruit set as compared with pollination at two days after spathe splitting in both experimental seasons respectively, this finding might be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of flowers receptive to Fertilization, but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma and style of the female flowers in better Fertilization and fruit set However, (Al-Delaimy & Ali, 1969; Albert, 1930; Brown et al., 1969; El-Kassas & Mahmoud, 1986; Rahim, 1975; Ream & Furr, 1970; Reuveni, 1970; Shaheen, 1986).

1-2" Effect of hours of day Time pollination on fruit set%: There was non-significant promotion on fruit set% with delaying time of pollination from 7am early morning to 5pm or before sun set. The best fruit set% was observed when pollination carried out at 5 pm or before sun set followed by 12 pm then 7am or early morning in descending order, these results may be due to as a result of availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

1-3"The Interaction effect between pollination Time after spathe cracking and hours of day Time pollination on fruit set%: Data concerning The Interaction effect between pollination Time after spathe cracking and hours of day Time pollination had a significant effect on fruit set. the maximum fruit set% (50.00 & 52.00%) in both growing seasons respectively was obtained when pollination performed at the second days after spathe cracking at time 5pm before sun set, while the minimum fruit set% (38.00&37.00%) in two experimental seasons respectively was detected by carrying pollination at the Fourth day after spathe splitting at time 7am early morning. These results are harmony with those obtained by (Brown et al., 1969).

2-Bunch weight (kg): Data concerning the effect of pollination Time after spathe cracking and hours of day Time pollination on bunch weight (kg) tabulated in table (2).

2-1" Effect of pollination Time after spathe cracking: It's indicated from the obtained data that of pollination Time after spathe cracking had a significant effect on Bunch weight. The heaviest bunch weight (kg) was obtained with carrying pollination at the second days after spathe cracking in two seasons respectively, while carrying pollination at the Fourth day after spathe cracking gave the lightest bunch weight (kg) in both seasons respectively. this finding might be attributed to poor and failure of fruit setting as result of delaying pollination

and reduction of Flowers receptive to Fertilization, but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma

and style of the female flowers in better Fertilization and fruit set (Brown et al., 1969; Shaheen, 1986).

Table (1) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on Fruit set (%)

Pollination Time during day (A)	2021				Pollination time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	41.00	42.00	38.00	40.3	Pollination after sunrise (7 am)	42.00	42.00	37.00	40.3
Pollination during mid-day (12 pm)	42.00	43.00	42.00	42.33	Pollination during mid-day (12 pm)	43.00	43.00	42.00	42.67
Pollination before sunset (5 pm)	50.00	43.43	45.00	46.14	Pollination before sunset (5 pm)	52.00	44.00	45.00	47.00
Mean	44.33	42.81	41.67		Mean	45.67	43.00	41.33	
New LSD _{0.05}	A ns B 0.947 AB 1.673				New LSD _{0.05}	A ns B 0.832 AB 1.447			

Table (2) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on Bunch weight (kg)

Pollination Time during day (A)	2021				Pollination time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	9.20	8.70	8.00	8.63	Pollination after sunrise (7 am)	9.00	8.60	8.10	8.57
Pollination during mid-day (12 pm)	10.00	10.00	9.00	9.67	Pollination during mid-day (12 pm)	9.80	9.70	9.10	9.53
Pollination before sunset (5 pm)	11.00	10.00	9.70	10.23	Pollination before sunset (5 pm)	12.00	11.00	9.60	10.87
Mean	10.07	9.57	8.90		Mean	10.27	9.77	8.93	
New LSD _{0.05}	A 0.061 B 0.072 AB 0.125				New LSD _{0.05}	A 0.187 B 0.156 AB 0.289			

2-2" Effect of hours of day Time pollination:

It's clear from the obtained data that hours of day Time pollination had significant effect on Bunch weight. The maximum value of bunch weight (kg) was recorded when pollination performed at time 5pm or before sun set in two growing seasons respectively, but the minimum ones were recorded with palms pollinated at time 7am in both experimental seasons respectively. These results may be due to availability of environmental conditions as well

as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

2-3" The interaction effect between pollination Time after spathe cracking and hours of day Time pollination: It's revealed from the previously data that the interaction between pollination Time after spathe cracking and hours of day Time pollination had a significant effect on Bunch weight. The highest

bunch weight (11.00&12.00kg) in both experimental seasons respectively was observed with carrying pollination at the second days after spathe cracking at time 5pm or before sun set, on the other hand the lowest ones (8.00&8.10kg) in two growing seasons respectively was observed when pollination performed at the Fourth day after spathe splitting at time 7am. this results are conformity with those obtained by (El-Kassas & Mahmoud, 1986; Shaheen, 1986).

3- Total yield (kg): Data regarding the effect of pollination Time after spathe cracking and hours of day Time pollination on total yield (kg) illustrated in table (3).

3-1" Effect of pollination Time after spathe cracking on total yield (kg): It's clear from the foregoing results that pollination Time after spathe cracking had a significant effect on total yield in both seasons. Total yield (kg) decreased with delaying pollination at four days after spathe opening in two growing seasons respectively, while the increment of total yield occurred by earlier pollination at two days after spathe splitting in both experimental seasons respectively, that may be due to this finding might be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of Flowers receptive to Fertilization,

but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma and style of the female flowers in better Fertilization and fruit set (Brown et al., 1969).

3-2" Effect of hours of day Time pollination on total yield (kg): It's evidence from the foregoing results that hours of day Time pollination had a significant effect on total yield in both seasons. The best total yield (kg) was obtained when carried out pollination at time 5pm or before sun set in both seasons respectively, but the check total yield (kg) was obtained when pollination performed at time 7am in two growing seasons respectively. These results may be attributed to availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

3-3" The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on total yield (kg): It's indicated from the previously data that the interaction between pollination Time after spathe cracking and hours of day Time pollination had a significant effect on total yield in both seasons.

Table (3) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on Total yield (kg/palm)

Pollination Time during day (A)	2021				Pollination Time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	73.60	69.60	64.00	69.07	Pollination after sunrise (7 am)	72.00	68.80	64.80	68.53
Pollination during mid-day (12 pm)	80.00	80.00	72.00	77.33	Pollination during mid-day (12 pm)	78.40	77.60	72.80	76.27
Pollination before sunset (5 pm)	88.00	80.00	77.60	81.87	Pollination before sunset (5 pm)	96.00	88.80	79.20	88.00
Mean	80.53	76.53	71.20		Mean	82.13	78.40	72.27	
New LSD_{0.05}	A 0.094 B 0.072 AB 0.125				New LSD_{0.05}	A 0.071 B 0.059 AB 0.102			

The heaviest total yield (88.00&96.00kg) in two growing seasons respectively was recorded when pollination performed at the second days after spathe cracking at time 5pm or before sun set, on the contrary the lightest total yield kg (64.00&64.80kg) in two seasons respectively was observed with carrying out pollination at the fourth day after spathe opening at time 7am. This finding is supported by (Iqbal et al., 2014; Shaheen, 1986).

4-Fruit weight (g): It's revealed from the obtained data in table (4) that the effect of pollination Time after spathe cracking and hours of day Time pollination on fruit weight show non-significant effect on Fruit weight in two successive seasons respectively.

4-1" Effect of pollination Time after spathe cracking on fruit weight (g): Data cleared that pollination Time after spa the had a significant effect on fruit weight (g).The maximum value of fruit weight in both seasons respectively, was observed with delaying pollination to fourth day after spathe splitting, on the contrary the minimum ones were recorded when palm trees pollinated at two days after spathe opening that may be due to this finding might be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of Flowers receptive to Fertilization, but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma and style of the female flowers in better Fertilization and fruit set However, (Al-Delaimy & Ali, 1969; Albert, 1930; Brown et al., 1969; El-Kassas & Mahmoud, 1986; Rahim, 1975; Ream & Furr, 1970; Reuveni, 1970; Shaheen, 1986).

4-2" Effect of hours of day Time pollination on fruit weight (g): Data disclosed that advancing the effect of hours of day Time pollination caused a significant promotion on fruit weight, the highest values of fruit weight in two growing seasons respectively were obtained with carrying pollination at time 7am or early morning, but the lowest ones were obtained pollination performed at time 5pm or before sun set in both successive seasons

respectively, this results may be due to the availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

4-3" The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on fruit weight (g): Data cleared that the maximum values of fruit weight (12.00&12.30g), in two experimental seasons respectively was recorded by carrying pollination at the Fourth day after spathe cracking at time 7am or early morning, on the other hand the minimum of fruit weight (8.90&8.20g), in two growing seasons respectively was observed when pollination performed at the second days after spathe splitting at time 5pm or before sun set, these results are in concordance with those obtained by This findings are in harmony with those obtained by (Iqbal et al., 2014; Shaheen, 1986).

5-Fruit length (cm): Data concerning the effect of pollination Time after spathe cracking and hours of day Time pollination on fruit length are given in table (5).

5-1" Effect of pollination Time after spathe cracking on fruit length (cm): It's indicated from the obtained data that pollination Time after spathe cracking had a significant effect on fruit length (cm). Delaying pollination after spathe splitting was accompanied with improving fruit length, the promotion was associated with delaying date of pollination. the best fruit length was recorded on palms pollinated at the Fourth day after spathe splitting, while pollination at the second days after spathe splitting resulted in unfavorable effects on fruit length in two growing seasons respectively. This results may be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of Flowers receptive to Fertilization, but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma and style of the female flowers in better

Fertilization and fruit set However, (Al-Delaimy & Ali, 1969; Albert, 1930; Brown et al., 1969; El-Kassas & Mahmoud, 1986; Rahim, 1975; Ream & Furr, 1970; Reuveni, 1970).

Table (4) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on Fruit weight (g)

Pollination Time during day (A)	2021				Pollination Time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	10.67	11.73	12.00	11.47	Pollination after sunrise (7 am)	11.90	12.00	12.30	12.07
Pollination during mid-day (12 pm)	9.40	10.70	11.00	10.37	Pollination during mid-day (12 pm)	9.20	10.80	11.20	10.40
Pollination before sunset (5 pm)	8.90	9.90	9.90	9.57	Pollination before sunset (5 pm)	8.20	9.90	9.97	9.36
Mean	9.66	10.78	10.97		Mean	9.77	10.90	11.16	
New LSD _{0.05}	A 0.177				New LSD _{0.05}	A 0.089			
	B 0.191					B 0.080			
	AB ns					AB 0.138			

5-2" Effect of hours of day Time pollination on fruit length (cm): Data regarding the hours of day Time pollination ad a significant effect on fruit length (cm), obviously reveal that pollination at time 7am or early morning gave best results, but the unfavorable effects on fruit length were recorded when pollination was conducted at the time 5pm or before sun set in two experimental seasons respectively, this results may be due to the availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

5-3" The interaction effect between pollination time after spathe cracking and hours of day time pollination on fruit length (cm): Studied combinations had a significant effect of fruit length (cm), the maximum value of fruit length (cm) (3.56&3.55 cm) in two growing seasons respectively was observed when pollination carried out at the fourth day after spathe cracking at time 7am at sun rise, On the contrary the minimum ones (3.37&3.40 cm) in two growing seasons respectively were obtained when palms pollinated at the second

days after spathe opening at time 5 pm or before sun set, These findings are in harmony with those obtained by (Iqbal et al., 2014; Shaheen, 1986).

6-Fruit width (cm): Data concerning the effect of pollination Time after spathe cracking and hours of day Time pollination on fruit width are given in table (6).

6-1" Effect of pollination Time after spathe cracking on fruit width (cm): It's indicated from the obtained data that pollination Time after spathe cracking had a significant effect on fruit width (cm). Delaying pollination after spathe splitting was accompanied with improving fruit width, the promotion was associated with delaying date of pollination. the best fruit width was recorded on palms pollinated at the Fourth day after spathe splitting, while pollination at the second days after spathe splitting resulted in unfavorable effects on fruit width in two growing seasons respectively. This result may be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of Flowers receptive to Fertilization, but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the

stigma and style of the female flowers in better Fertilization and fruit set (Brown et al., 1969; Shaheen, 1986).

6-2" Effect of hours of day Time pollination on fruit width (cm): Data regarding the hours of day Time pollination ad a significant effect on fruit width (cm), obviously reveal that pollination at time 7am or early morning gave best results, but the unfavorable effects on fruit width were recorded when pollination was conducted at the time 5pm or before sun set in two experimental seasons respectively, this results may be attributed to the availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those

obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

6-3" The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on fruit width (cm): Studied combinations had a significant effect of fruit width (cm), the maximum value of fruit width (cm) (2.79&2.80 cm) in two growing seasons respectively was observed when pollination carried out at the Fourth day after spathe cracking at time 7am at sun rise, On the contrary the minimum ones (2.15&2.11 cm) in two growing seasons respectively were obtained when palms pollinated at the second days after spathe opening at time 5pm or before sun set, This findings are in harmony with those obtained by (Iqbal et al., 2014; Shaheen, 1986).

Table (5) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on fruit length (cm)

Pollination Time during day (A)	2021				Pollination time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	3.42	3.50	3.56	3.49	Pollination after sunrise (7 am)	3.45	3.52	3.55	3.51
Pollination during mid-day (12 pm)	3.42	3.44	3.49	3.45	Pollination during mid-day (12 pm)	3.40	3.44	3.48	3.44
Pollination before sunset (5 pm)	3.37	3.40	3.40	3.39	Pollination before sunset (5 pm)	3.40	3.40	3.40	3.40
Mean	3.40	3.45	3.48		Mean	3.42	3.45	3.48	
New LSD _{0.05}	A 0.019				New LSD _{0.05}	A 0.035			
	B 0.013					B 0.043			
	AB 0.024					AB 0.098			

Table (6) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on fruit width (cm)

Pollination Time during day (A)	2021				Pollination time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	2.45	2.60	2.79	2.61	Pollination after sunrise (7 am)	2.45	2.62	2.80	2.62
Pollination during mid-day (12 pm)	2.19	2.21	2.21	2.20	Pollination during mid-day (12 pm)	2.15	2.17	2.20	2.17
Pollination before sunset (5 pm)	2.15	2.15	2.37	2.22	Pollination before sunset (5 pm)	2.11	2.16	2.21	2.16
Mean	2.33	2.32	2.45		Mean	2.24	2.32	2.40	
New LSD _{0.05}	A 0.006				New LSD _{0.05}	A 0.007			
	B 0.009					B 0.008			
	AB 0.015					AB 0.013			

7-TSS%: Data concerning the effect of pollination time after spathe cracking and hours of daytime pollination on TSS are given in table (7).

7-1" Effect of pollination Time after spathe cracking on TSS%: It's indicated from the obtained data that pollination Time after spathe cracking had a significant effect on TSS%. Delaying pollination after spathe splitting was accompanied with improving TSS %, the promotion was associated with delaying date of pollination. The best fruit TSS% was recorded on palms pollinated at the Fourth day after spathe splitting, while pollination at the second days after spathe splitting resulted in unfavorable effects on TSS% in two growing seasons respectively. These results may be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of Flowers receptive to Fertilization, but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma and style of the female flowers in better Fertilization and fruit set (Brown et al., 1969; Shaheen, 1986).

7-2" Effect of hours of daytime pollination on TSS%. Data regarding the hours of daytime

pollination ad a significant effect on TSS%, obviously reveal that pollination at time 7am or early morning gave best results, but the unfavorable effects on TSS% were recorded when pollination was conducted at the time 5pm or before sun set in two experimental seasons respectively, as a result of availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

7-3" The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on TSS%: Studied combinations had a significant effect of TSS%, the maximum value of TSS% (61.20&60.10 cm) in two growing seasons respectively was observed when pollination carried out at the Fourth day after spathe cracking at time 7am at sun rise, On the contrary the minimum ones (54.30&53.30 cm) in two growing seasons respectively were obtained when palms pollinated at the second days after spathe opening at time 5pm or before sun set, this findings are in harmony with those obtained by (Iqbal et al., 2014; Shaheen, 1986).

Table (7) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on TSS %

Pollination Time during day (A)	2021				Pollination time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	59.90	59.90	61.20	60.33	Pollination after sunrise (7 am)	59.03	59.73	60.10	59.62
Pollination during mid-day (12 pm)	58.10	58.30	58.70	58.37	Pollination during mid-day (12 pm)	57.73	58.40	59.40	58.51
Pollination before sunset (5 pm)	54.30	55.60	56.90	55.60	Pollination before sunset (5 pm)	53.50	54.60	56.80	54.97
Mean	57.43	57.93	58.93		Mean	56.76	57.58	58.77	
New LSD _{0.05}	A 0.123				New LSD _{0.05}	A 0.369			
	B 0.051					B 0.176			
	AB 0.088					AB 0.304			

8-Total sugar (%): It's revealed from the obtained data in table (8) that the effect of pollination Time after spathe cracking and

hours of day Time pollination on total sugar show a significant effect on Total sugar (%) in two successive seasons respectively.

8-1" Effect of pollination Time after spathe cracking on total sugar (%): Data cleared that pollination Time after spa the had a significant effect on total sugar (%) The maximum value of total sugar (%) in both seasons respectively, was observed with delaying pollination to fourth day after spathe splitting, on the contrary the minimum ones were recorded when palm trees pollinated at two days after spathe opening, this finding might be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of Flowers receptive to Fertilization, but earlier pollination may be due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma and style of the female flowers in better Fertilization and fruit (Al-Delaimy & Ali, 1969; Albert, 1930; Brown et al., 1969; El-Kassas & Mahmoud, 1986; Rahim, 1975; Ream & Furr, 1970; Reuveni, 1970)

8-2" Effect of hours of day Time pollination on total sugar (%): Data disclosed that hours of day Time pollination caused a significant promotion on total sugar (%), the highest values of total sugar (%) in two growing seasons

Table (8) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on Total sugar (%)

Pollination Time during day (A)	2021				Pollination time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	55.50	55.10	55.90	55.50	Pollination after sunrise (7 am)	56.50	57.80	58.90	57.73
Pollination during mid-day (12 pm)	52.50	52.10	53.10	52.57	Pollination during mid-day (12 pm)	53.50	53.80	54.00	53.77
Pollination before sunset (5 pm)	49.30	50.60	50.10	50.00	Pollination before sunset (5 pm)	51.10	51.40	51.60	51.37
Mean	52.43	52.87	52.77		Mean	53.70	54.33	54.83	
New LSD _{0.05}	A 0.087				New LSD _{0.05}	A 0.071			
	B 0.098					B 0.059			
	AB 0.169					AB 0.102			

9-Total acidity (%): It's revealed from the obtained data in table (9) that the effect of pollination Time after spathe cracking and hours of day Time pollination show a significant effect on Total acidity (%) in two successive seasons respectively.

respectively were obtained with carrying pollination at time 7 am or early morning, but the lowest ones were obtained pollination performed at time 5 pm or before sun set in both successive seasons respectively, as a result of availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014)

8-3" The interaction effect between pollination time after spathe cracking and hours of day time pollination on total sugar (%): Data cleared that the maximum values of total sugar% (55.90&98.90%), in two experimental seasons, respectively was recorded by carrying pollination at the fourth day after spathe cracking at time 7am or early morning, on the other hand the minimum of total sugar %(49.30&51.10%), in two growing seasons respectively was observed when pollination performed at the second days after spathe splitting at time 5pm or before sun set, these results are in concordance with those obtained by (Iqbal et al., 2014; Shaheen, 1986).

Time after spathe cracking and hours of day Time

pollination on Total sugar (%)

9-1" Effect of pollination Time after spathe cracking on Total acidity (%): Data cleared that pollination Time after spa the had a significant effect on Total acidity (%), the minimum value of total acidity (%) in both seasons, respectively was observed with

delaying pollination to fourth day after spathe splitting, on the contrary The maximum ones were recorded when palm trees pollinated at two days after spathe opening, this finding might be attributed to poor and failure of fruit setting as result of delaying pollination and reduction of Flowers receptive to Fertilization, but earlier pollination maybe due to that the pollen grain tube can easily germinate and elongate to penetrate the stigma and style of the female flowers in better Fertilization and fruit set (Brown et al., 1969; Shaheen, 1986).

9-2" Effect of hours of day Time pollination on Total acidity (%): Data disclosed that hours of day Time pollination caused a significant effect on Total acidity (%), the lowest values of Total acidity (%) in two growing seasons respectively were obtained with carrying pollination at time 7am or early morning, but the highest ones were obtained pollination performed at time 5pm or before sun set in both successive seasons respectively, this results may be due to availability of environmental conditions as well as temperature and relative humidity in this time. These results are in harmony with those obtained by (Djerbi, 1995; Dowson, 1982; Iqbal et al., 2014).

9-3" The interaction effect between pollination time after spathe cracking and hours of day time pollination on total acidity (%): Data cleared that the minimum values of

on total acidity % (0.157&0.166%), in two experimental seasons respectively was recorded by carrying pollination at the fourth day after spathe cracking at time 7am or early morning, on the other hand the maximum of on total acidity %) 0.316&0.316%), in two growing seasons respectively was observed when pollination performed at the second days after spathe splitting at time 5pm or before sun set, these results are in concordance with those obtained by (Iqbal et al., 2014; Shaheen, 1986).

Conclusions

Artificial pollination is considered the only way for commercial date production. from foregoing results it's noticed that carrying pollination after two days from spathe cracking at time 5 pm or before sun set gave the highest values of fruit set and total yield with low fruit quality, on the other hand pollination carried out at the fourth day after spathe cracking at time 7am after sun raise gave the lowest values of fruit set and total yield with high quality of fruits. For promoting yield of Seewy date palms grown under El Dakhla conditions, New Valley Governorate palms should be pollinated at the second days after spathe cracking at time 5pm or before sun set.

Conflicts of Interest/ Competing interest

All authors declare that they have no conflicts of interest.

Table (9) The interaction effect between pollination Time after spathe cracking and hours of day Time pollination on Total acidity (%)

Pollination Time during day (A)	2021				Pollination time during day (A)	2022			
	Days after spathe cracking (B)					Days after spathe cracking (B)			
	(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean		(b ₁) after two days	(b ₂) after three days	(b ₃) after four days	Mean
Pollination after sunrise (7 am)	0.160	0.161	0.157	0.159	Pollination after sunrise (7 am)	0.162	0.159	0.166	0.162
Pollination during mid-day (12 pm)	0.230	0.234	0.210	0.225	Pollination during mid-day (12 pm)	0.233	0.158	0.210	0.200
Pollination before sunset (5 pm)	0.316	0.316	0.307	0.313	Pollination before sunset (5 pm)	0.316	0.315	0.313	0.315
Mean	0.235	0.236	0.226		Mean	0.237	0.211	0.230	
New LSD _{0.05}	A 0.001				New LSD _{0.05}	A 0.001			
	B 0.001					B 0.001			
	AB 0.002					AB 0.001			

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