

Improving Fruit Set and Productivity of Barhee Date Palm under Heat Stress Conditions

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ABSTRACT

This study was conducted during 2016 and 2017 seasons on about 10 years-old Barhee date palm trees grown in Agriculture Research Center farm at Toshka, Aswan Governorate, Egypt, as an attempt to solve pollination problems of Barhee date palm cultivar under heat stress. Seven pollination treatments were applied on flowers (T1) the normal (control) pollination by inserting ten male strands / female spathe, (T2) spray female spathes by sugar solution at 4g/L and then pollen grains were pushed out, (T3) pollen grains suspended in sugar solution at 4g/L and then spray on female spathes, (T4) spray female spathes by Borax solution at 4g/L and then pollen grains were pushed out, (T5) pollen grains suspended in Borax solution at 4g/L and then spray on female spathes. (T6) spray female spathes by NAA solution at 0.5g/L and then pollen grains were pushed out and (T7) pollen grains suspended in NAA solution at 0.5g/L and then spray on female spathes. Results revealed that spraying sugar, borax and NAA solution on female spathes of Barhee date palm before pollination or suspended with pollen grains significantly improved fruit set and retention besides, increased bunch weight, palm yield, fruit physical and chemical properties comparing with pollination by traditional method (control). The best treatment in this study was spraying female spathes by Borax solution at 4g/L and then pollen grains were pushed out. This study recommends spraying female spathes by Borax solution at 4g/L before pollination Barhee date palm trees under heat stress conditions.

Keywords: Tushka conditions, Barhee date palm cultivar, Sugar solution, Borax, NAA, Pollination.

INTRODUCTION

Date palm is the most common fruit tree grown under hot stresses, semi-arid and arid-regions (Marzouk, 2011). According to the statistical records in Egypt, the number of fruitful female palms is almost fourteen million (14,956,331) planted in approximately 115610feddan producing (1684917) metric tons of fresh, semi-dry and dry dates (FAO, 2015). Fruit set and low fruit quality are a serious problems facing date palm growers (Amarante *et al.* 2002 & Ding *et al.* 2003). Fruit drop is genetically, physiologically and environmentally problem (Wu *et al.* 2009 & Zhang *et al.* 2005). Stress factors such as heat, drought, nutrient imbalance or deficiency, and heavy crop load contribute to fruit drop (Gao *et al.* 2007 & Liu *et al.* 2003).

Pollination is considered the most important horticultural practices in date palms orchards for obtaining an economical yield and fruits with better quality. The traditional method of pollination included the use of seven to ten male strands inside each female spathe just when opened. Date palm "Barhee" cultivar have some problems in the pollination, that cause a decrease production of the seeded fruits (economic yield), and production of a big amount of the seedless or sees fruits (non-economic fruits). In the same trend, using of the obligatory pollination increased the percentages of the fruit set by 98.7 comparing with 89.2% in case of the normal pollination after 3-5 days from the perianth' cracking (anthesis or flowering) (Al-khateeb *et al.* 2003). Therefore, many trials were made using suspensions of grains applied by sprayers.

Efficient pollination is connected with the period when pollen could fertilize the ovule. It depends upon the ovule longevity as well as on growth speed of pollen tube. Pollen grains germination is closely affected in the environmental factors and stigma receptivity (Ruther and Crawford, 1964). The pollen tube germination depends upon temperature, which is highly susceptible to low and high temperature resulted poor germination of pollen grains (Albert, 1930; Ream and Furr, 1968).

The cardinal temperatures for the survival of the date palm ranged from -5°C as the minimum to 50 °C as the maximum temperatures with 35 °C as the optimum temperature for pollen germination (Smartt, 1995). (Mason 1925) observed that date palms survived extreme temperatures when -15°C to 52°C. The minimum temperatures of 0 °C and maximum temperatures up to 58 °C were suitable for growth as reported by (Dowson 1982).

Applying pollen grain suspended in water was more efficient when pollens are in a small quantity than pollination by pollen only. The effect of pollen grains-water suspension application at different concentrations on fruit set, yield and quality were examined on 'Lulu' date palm cultivar growing under Al-Ain oasis conditions, UAE. The results showed that pollen grains-water suspension (PGWS) application at 0.5, 1, 1.5 g/l gave fruit set percentage of 75.6, 86.8, and 87.8%, respectively which was lower than control (traditionally pollinated) that reached about (90.0%) (Mohamed 2011).

Therefore, many trials were carried out for using pollen grain suspended in sucrose, mineral and some growth regulators to improving date palm pollination an increasing yield and fruit quality as (Soliman and AL Obeed 2011) whose found that Boric acid (H_3BO_3) at 0.6 % + sugar at 2g/L treatment improved retained fruits, bunch weight, fruit physical and chemical characteristics i.e. fruit weight, volume, dimensions, total soluble solids and total sugars contents than the other treatments and control for Khalas and Nabout-sif date palm cultivars. This results were in agree with those of (mostafa 1994, on Zaghoul and Samany dates, Osman 1999, Hassan 2000, Abd El-Migeed *et al.* 2002 on Olive trees, Attalla *et al.* 2007 on Zaghoul date palm, Desouky *et al.* 2007 on Barhee date palm and Dialamy and Alihori 2010 on Sayer date palm.

So this present study was carried out to find a solution for pollination problems of Barhee date palm cultivar under heat stress.

MATERIALS AND METHODS

This experiment was conducted for the two successive seasons 2016 and 2017 at agriculture research center farm located in Toshka Aswan governorate. Twenty one date palm trees of Barhee, cv. ten years old planted in sandy loam soil at 7x 7 meters apart and similar in vigor were selected for the study. Ten female spathes were left on each tree and others were removed. The pollination dates were 12th March and 10th March in 2016 and 2017, respectively on whole spathes of tree. Male mature spathes were cut soon sheath crack appeared at the top of spathe. The protective spathe sheet was removed. The pollen grains were extracted by shaking the strands on a white paper sheet. Then, the pollens were separated from other floral parts by using thin silk bolters.

The experiment was designed in Randomized Complete Block Design (RCBD) having seven pollination treatments in three replications. All the standard cultural practices were done during the course of this study. The detail of the treatments were as follows:

- T1. Control (normal pollination by inserting ten male strands / female spathe).
- T2. Spray female spathes by sugar solution at 4g/L and then pollen grains were pushed out.
- T3. Pollen grains suspended in sugar solution at 4g/L and then spray on female spathes.
- T4. Spray female spathes by Borax solution at 4g/L and then pollen grains were pushed out.
- T5. Pollen grains suspended in Borax solution at 4g/L and then spray on female spathes.
- T6. Spray female spathes by NAA solution at 0.5g/L and then pollen grains were pushed out.
- T7. Pollen grains suspended in NAA solution at 0.5g/L and then spray on female spathes.

After spathe pollination, the inflorescence was wrapped by paper bags. Thereafter, the bags were removed out after four weeks from pollination period. The air temperatures and relative humidity in study region during 2015 and 2016 years were as in table (1).

Table 1. Air temperatures and relative humidity in study region during 2015 and 2016 years

Month	2015						2016					
	Air temperature			relative humidity			Air temperature			relative humidity		
	Maxi-	Mini-	Aver-	Maxi-	Mini-	Aver-	Maxi-	Mini-	Aver-	Maxi-	Mini-	Aver-
January	23.84	9.15	16.50	55.5	21.8	38.7	22.32	9.89	16.10	53.97	22.58	38.28
February	27.94	12.06	20.00	45.79	12.68	29.24	27.68	12.33	20.00	45.56	13.34	29.45
March	32.41	15.80	24.10	33.71	4.82	19.26	33.45	16.63	25.04	41.02	7.67	24.35
April	33.3	16.1	23.9	25.0	4.2	14.6	38.08	19.25	28.67	25.94	3.53	14.73
May	38.82	22.73	30.77	26.09	4.20	15.15	40.86	23.53	32.19	22.75	3.27	13.01
June	40.36	25.18	32.77	32.19	5.73	18.96	43.47	25.85	34.66	21.92	3.17	12.55
July	41.24	24.08	32.66	28.35	4.78	16.56	41.97	26.49	34.23	26.03	5.18	15.60
August	44.03	29.14	36.59	28.36	5.72	17.04	41.92	26.44	34.18	27.86	4.98	16.42
September	42.29	26.68	34.49	28.93	4.91	16.92	40.07	24.64	32.35	31.78	7.03	19.41
October	38.38	23.87	31.13	40.97	10.68	25.82	37.46	21.77	29.61	37.62	11.57	24.60
November	29.86	15.58	22.72	54.68	22.34	38.51	32.14	17.83	24.99	47.97	19.00	33.48
December	23.11	9.94	16.52	61.09	25.93	43.51	31.15	16.58	23.87	48.97	20.12	34.55

The following parameters were recorded:

Fruit set percentage: Ten strands per spathe were selected for recording of abnormal and normal fruit set. Fruit setting percentage was calculated by using the following formula:

$$\text{Fruit set\%} = \frac{\text{Total number of normal fruit set} - \text{Number of abnormal fruits set}}{\text{Total number of fruits}} \times 100$$

Fruit drop percentage: Fruit drop percentage was calculated by using the following formula:

$$\text{Fruit drop percentage} = \frac{\text{Total number of fruit set} - \text{number of retained fruits}}{\text{Total number of fruit set}} \times 100$$

Fruit retention Percentage: Fruit retention percentage was calculated by using the following formula:

$$\text{Fruit retention percentage} = \frac{\text{Total number of retained fruits}}{\text{Total number of fruit set}} \times 100$$

Palm yield (Kg): at harvest time average bunch weight were recorded and palm yield were calculated.

Fruit physical properties: Twenty fruits from all treatments were selected to determine fruit physical properties as fruit weight (g), fruit length (cm), fruit diameter (cm), fruit shape index, flesh weight (g), seed weight (g) and flesh percentage.

Fruit chemical properties: To determine fruit chemical properties fifty gram from fruit flesh were blended in 100 ml distilled water using special electric mixer, then filtered and the filtrate was taken for analysis) according to A. O. A. C. (2005). Total soluble solids (T.S.S.) in fruit juice were determined using CarlZeiss hand

refractometer. Total and reducing sugars percentage were determined according to Miller, G.L. (1959) and non-reducing was calculated. Titratable acidity percentage in fruit juice was determined according to Vogel, (1968) and TSS/acid ratio was calculated.

Statistical Analysis: The obtained data of both seasons were subjected to analysis of variance according to Snedecor and Cochran, (1989) and the means were differentiated using Duncan multiple range test at 5% level. Duncan, (1955).

RESULTS AND DISCUSSION

Fruit set, drop and retention percentage:

Data in table (2) clearly show that spraying sugar, borax and NAA solutions on female spathes of Barhee date palm cultivar before pollination or suspended with pollen grains significantly increased fruit set and retention percentage and reduce fruit drop percentage comparing with pollination with traditional pollination method (control).

Moreover, no significant differences between using pollen grains suspended in Borax solution at 4g/L and then spray on female spathes and spraying female spathes palms by NAA before pollination or pollen grains suspended in NAA solution at 0.5g/L and then spray on female spathes.

Table 2. effect of sugar solution, Borax and NAA application on fruit set, fruit drop and fruit retention percentage of Barhee date palm during 2016&2017 seasons.

Treatments	Fruit set (%)		Fruit drop (%)		Fruit retention (%)	
	2016	2017	2016	2017	2016	2017
	(T1) control (normal pollination by inserting ten male strands / female spathe).	64.98 D	64.96 D	12.26 A	11.14 A	52.71 D
(T2) spray female spathes by sugar solution at 4g/L and then pollen grains were pushed out.	71.51 C	71.49 C	8.14 B	7.02 B	63.37 BC	64.47 BC
(T3) pollen grains suspended in sugar solution at 4g/L and then spray on female spathes.	73.66 BC	75.67 BC	10.70 AB	9.58 AB	64.99 B	66.09 B
(T4) spray female spathes by Borax solution at 4g/L and then pollen grains were pushed out.	78.22 A	78.20 A	10.47 AB	9.36 AB	67.75 A	68.85 A
(T5) pollen grains suspended in Borax solution at 4g/L and then spray on female spathes.	73.37 BC	73.35 BC	11.09 AB	9.97 AB	62.28 C	63.38 C
(T6) spray female spathes by NAA solution at 0.5g/L and then pollen grains were pushed out.	73.66 BC	73.64 BC	10.18 AB	9.69 AB	62.85 C	63.95 C
(T7) pollen grains suspended in NAA solution at 0.5g/L and then spray on female spathes.	73.08 BC	73.06 BC	10.48 AB	9.56 AB	62.41 C	63.51 C

Means with the same letter are not significantly different.

The maximum values of fruit set and retention percentage were recorded with spray female spathes palms by Borax solution at 4g/L before pollination (78.22 & 78.20) and (67.75 & 68.85), respectively in two studied seasons. In addition, this treatment gave the minimum values of fruit drop percentage during both seasons.

These results may be due to the increase in pollen grains germination and pollen tube elongation due to borax treatment. The obtained results are in agreement with the findings of Soliman and AL Obeed (2011) whose found that Boric acid (H₃ BO₃) at 0.6 % + sugar at 2g/L treatment improved retained fruits of Khalas and Nabout-sif date palm cultivars and Desouky *et al*, (2007) on Barhee date palm, they also found that the all boron spraying treatments improved yield, retained fruits.

Bunch weight and Palm yield (kg):

Data presented in table (3) reveal that spraying sugar, borax and NAA solution on female spathes of

Barhee date palm before pollination or suspended with pollen grains significantly improved palm bunch weight and yield (kg) comparing with pollination with traditional pollination method (control). In this respect, no significant differences between using pollen grains suspended in Borax solution at 4g/L and then spray on female spathes and pollen grains suspended in sugar solution at 4g/L and then spray on female spathes or between spraying sugar or NAA solution before pollination.

The highest values of palm bunch weight and yield (10.63&10.73 kg) and (106.33&107.33 kg), respectively were recorded on spray female spathes palms by Borax solution at 4g/L before pollination in 2016 &2017 season, respectively. In addition, the minimum values of palm bunch weight and yield (8.48&8.58 kg) and (84.77&85.77 kg) were obtained from pollination by traditional method (control) during both seasons, respectively.

Table 3. effect of sugar solution, Borax and NAA application on yield of Barhee date palm during 2016&2017 seasons.

Treatments	Bunch weight(kg)		Palm yield (kg)	
	2016	2017	2016	2017
(T1) control (normal pollination by inserting ten male strands / female spathe).	8.48C	8.58C	84.77C	85.77C
(T2) spray female spathes by sugar solution at 4g/L and then pollen grains were pushed out.	9.31BC	9.41BC	93.07BC	94.07BC
(T3) pollen grains suspended in sugar solution at 4g/L and then spray on female spathes.	10.21AB	10.31AB	102.13AB	103.13AB
(T4) spray female spathes by Borax solution at 4g/L and then pollen grains were pushed out.	10.63A	10.73A	106.33A	107.33A
(T5) pollen grains suspended in Borax solution at 4g/L and then spray on female spathes.	9.83AB	9.93AB	98.30AB	99.30AB
(T6) spray female spathes by NAA solution at 0.5g/L and then pollen grains were pushed out.	9.29BC	9.39BC	92.87BC	93.87BC
(T7) pollen grains suspended in NAA solution at 0.5g/L and then spray on female spathes.	9.43BC	9.44BC	93.43BC	94.43BC

Means with the same letter are not significantly different.

These results may be due to improving fruit set and retention percentage and reducing fruit drop percentage which led to increasing bunch weight and palm yield. These results are in agree with Attalla *et al*, (2007) on Zaghoul date palm, Desouky *et al*, (2007) on Barhee date palm, Dialamy and Alihori, (2010) on Sayer date palm and Soliman and AL Obeed (2011) on Khalas and Nabout-sif date palm cultivars

Fruit physical properties:

Regarding data in tables (4&5) we find that spraying sugar, borax and NAA solution on female spathes of Barhee date palm before pollination or suspended with pollen grains significantly led to increasing in all studied parameters of fruit physical properties i.e. (fruit length, diameter, shape index,

weight, flesh weight and flesh percentage) comparing with pollination with traditional pollination method (control).

The highest values of fruit length (3.8&3.7cm), diameter (2.83&2.68cm), weight (19.34&19.09 g) and flesh weight (17.46&17.35g) were obtained from spray female spathes palms by Borax solution at 4g/L before pollination but pollen grains suspended in sugar solution at 4g/L and then spray on female spathes treatment gave the highest values of fruit shape index(1.38&1.42) and flesh percentage(94.16&94.89%) comparing with the minimum values obtained from pollination by traditional method (control) in 2016&2017 seasons respectively.

These results are in agree with the findings by Soliman and AL Obeed, (2011) whose found that Boric acid

(H3 BO3) at 0.6 % + sugar at 2g/L treatment improved fruit physical i.e. fruit weight, volume and dimensions for Khalas and Nabout-sif date palm cultivars, and with those Attalla et

al,(2007 on zaghoul date palm and Desouky et al, (2007) on Barhee date palm. They reported that fruit dimensions of date were increased as a result of boric acid applications.

Table 4. effect of sugar solution, Borax and NAA application on fruit length (cm), fruit diameter (cm) and fruit shape index of Barhee date palm during 2016&2017 seasons.

Treatments	Fruit length (cm)		Fruit diameter(cm)		Fruit shape index	
	2016	2017	2016	2017	2016	2017
(T1) control (normal pollination by inserting ten male strands / female spathe).	3.17 D	3.07 D	2.37 D	2.22 D	1.34 AB	1.38 AB
(T2) spray female spathes by sugar solution at 4g\L and then pollen grains were pushed out.	3.43 C	3.33 C	2.63 B	2.48 B	1.31 B	1.34 B
(T3) pollen grains suspended in sugar solution at 4g\L and then spray on female spathes.	3.63 AB	3.53 AB	2.63 B	2.48 B	1.38 A	1.42 A
(T4) spray female spathes by Borax solution at 4g\L and then pollen grains were pushed out.	3.80 A	3.70 A	2.83 A	2.68 A	1.34 AB	1.38 AB
(T5) pollen grains suspended in Borax solution at 4g\L and then spray on female spathes.	3.63 AB	3.53 AB	2.67 B	2.52 B	1.36 AB	1.40 AB
(T6) spray female spathes by NAA solution at 0.5g\L and then pollen grains were pushed out.	3.53 BC	3.43 BC	2.70 B	2.55 B	1.31 AB	1.34 B
(T7) pollen grains suspended in NAA solution at 0.5g\L and then spray on female spathes.	3.43 C	3.33 C	2.53 C	2.38 C	1.36 AB	1.40 AB

Means with the same letter are not significantly different.

Table 5. effect of sugar solution, Borax and NAA application on fruit weight, flesh weight and flesh percentage of Barhee date palm during 2016&2017 seasons.

Treatments	Fruit weight (g)		Flesh weight (g)		Flesh (%)	
	2016	2017	2016	2017	2016	2017
(T1) control (normal pollination by inserting ten male strands / female spathe).	14.81 E	14.55 E	12.21 E	12.10 E	82.59 C	83.25 C
(T2) spray female spathes by sugar solution at 4g\L and then pollen grains were pushed out.	16.37 D	16.12 D	15.09 D	14.98 D	92.19 AB	92.94 AB
(T3) pollen grains suspended in sugar solution at 4g\L and then spray on female spathes.	17.23 C	16.98 C	16.22 BC	16.11 BC	94.16 A	94.89 A
(T4) spray female spathes by Borax solution at 4g\L and then pollen grains were pushed out.	19.34 A	19.09 A	17.46 A	17.35 A	90.31 AB	90.92 AB
(T5) pollen grains suspended in Borax solution at 4g\L and then spray on female spathes.	18.51 B	18.26 B	13.78 B	16.67 BC	90.63 AB	91.27 AB
(T6) spray female spathes by NAA solution at 0.5g\L and then pollen grains were pushed out.	18.21 B	17.96 B	16.13 C	16.02 C	88.57 B	89.19 B
(T7) pollen grains suspended in NAA solution at 0.5g\L and then spray on female spathes.	17.23 C	17.32 C	15.75 C	15.64 C	89.66 AB	90.32 AB

Means with the same letter are not significantly different.

Fruit chemical properties:

Data tabulated in tables (6&7) report that spraying sugar, borax and NAA solution on female spathes of Barhee date palm before pollination or suspended with

pollen grains significantly improving fruit chemical properties i.e. (TSS, acidity , TSS/acid ratio, total sugars, reducing, and non-reducing) compared to pollination with traditional pollination method (control).

Table 6. effect of sugar solution, Borax and NAA application on TSS, total acidity and TSS/acid ratio of Barhee date palm during 2016&2017 seasons.

Treatments	TSS		Acidity		TSS/acid ratio	
	2016	2017	2016	2017	2016	2017
(T1) control (normal pollination by inserting ten male strands / female spathe).	28.90 C	28.78 C	0.38 A	0.39 A	76.80 D	74.50 D
(T2) spray female spathes by sugar solution at 4g\L and then pollen grains were pushed out.	29.50 C	29.38 C	0.35 B	0.36 B	85.25 D	82.51 D
(T3) pollen grains suspended in sugar solution at 4g\L and then spray on female spathes.	32.96 A	32.84 A	0.28 C	0.29 C	116.86 C	112.43 C
(T4) spray female spathes by Borax solution at 4g\L and then pollen grains were pushed out.	33.43 A	33.31 A	0.20 E	0.21 E	164.57 A	156.29 A
(T5) pollen grains suspended in Borax solution at 4g\L and then spray on female spathes.	32.39 A	32.27 A	0.20 E	0.21 E	159.40 A	151.36 A
(T6) spray female spathes by NAA solution at 0.5g\L and then pollen grains were pushed out.	31.21 B	31.09 B	0.24 D	0.25 D	130.40 B	124.67 B
(T7) pollen grains suspended in NAA solution at 0.5g\L and then spray on female spathes.	31.17 B	31.05 B	0.24 D	0.25 D	129.97 B	124.29 B

Means with the same letter are not significantly different.

It is obvious from table (5) that, the highest values of TSS (33.43&33.31) were obtained from spray female spathes

palms by Borax solution at 4g\L before pollination but no significant differences between this treatment and pollen

grains suspended in sugar or Borax solution at 4g/L and then spray on female spathes in 2016&2017 respectively.

Besides, the highest TSS/acid ratio (164.57 & 156.29) and the lowest values of total acidity (0.20&0.21) were obtained from spraying female spathes palms by Borax solution at 4g/L before pollination but there were no significant differences between this treatment and pollen grains suspended in borax solution at 4g/L and then spray on female spathes treatment as compared to the obtained from pollination by traditional method (control) in 2016&2017 seasons respectively.

Regarding, data presented in table (7) mentioned that spraying female spathes of Barhee date palm cultivar by sugar, borax and NAA solution before pollination or suspended with pollen grains enhanced fruit chemical properties i.e. (reducing, non-reducing and total sugars) in both studied seasons compared to pollination with traditional pollination method (control).

Table 7. effect of sugar solution, Borax and NAA application on total sugars, reducing sugars and non-reducing sugars percentage of Barhee date palm during 2016&2017 seasons.

Treatments	Total sugars %		Reducing sugars %		Non-reducing sugars %	
	2016	2017	2016	2017	2016	2017
(T1) control (normal pollination by inserting ten male strands / female spathe).	25.41	25.51	18.86	18.75	6.54	6.75
	D	D	C	C	CD	CD
(T2) spray female spathes by sugar solution at 4g/L and then pollen grains were pushed out.	25.98	26.08	20.45	20.34	5.52	5.73
	D	D	B	B	D	D
(T3) pollen grains suspended in sugar solution at 4g/L and then spray on female spathes.	29.71	29.81	20.79	20.68	8.92	9.13
	B	B	B	B	A	A
(T4) spray female spathes by Borax solution at 4g/L and then pollen grains were pushed out.	31.04	31.04	22.26	22.15	8.77	8.98
	A	A	A	A	A	A
(T5) pollen grains suspended in Borax solution at 4g/L and then spray on female spathes.	30.63	30.73	21.92	21.81	8.71	8.92
	A	A	A	A	A	A
(T6) spray female spathes by NAA solution at 0.5g/L and then pollen grains were pushed out.	28.24	28.34	20.42	20.31	7.82	8.03
	C	C	B	B	AB	AB
(T7) pollen grains suspended in NAA solution at 0.5g/L and then spray on female spathes.	28.25	28.35	20.68	20.57	7.57	7.78
	C	C	B	B	BC	BC

Means with the same letter are not significantly different.

CONCLUSION

It is clear from this study that spraying sugar, borax and NAA solution on female spathes of Barhee date palm cultivar before pollination or suspended with pollen grains improved fruit set and retention and decreased fruit drop which reflected on increasing yield and fruit quality. The best treatment in this study was spraying female spathes by Borax solution at 4g/L before pollination. The highest values in fruit set; yield and fruit quality. This may be due to the enhancement of pollen tube elongation under heat stress and increase fertilization. So we could be recommending spraying the female spathes by Borax solution at 4g/L before pollination to improve fruit set and productivity of Barhee date palm grown under heat stress conditions.

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In this respect, spraying female spathes by Borax solution at 4g/L before pollination gave the highest values of total sugars (31.04&31.04), reducing sugars (22.26&22.15) and non-reducing sugars (8.92&9.13), respectively but no significant differences between this treatment and using pollen grains suspended in Borax solution at 4g/L and then spray on female spathes in this respect in both seasons compared to control and other treatments.

These results are agree with the findings of Soliman and AL Obeed (2011) whose found that Boric acid (H3 BO3) at 0.6 % + sugar at 2g/L treatment improved total soluble solids and total sugars contents than the other treatments and control for Khalas and Nabout-sif date palm cultivars and Attalla *et al*, (2007) on zaghoul date palm and Desouky *et al*, (2007) on Barhee date palm. They also reported that fruit chemical properties of date were increased as a result of boric acid treatments.

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تحسين عقد الثمار وانتاجية نخيل البلح البارحي تحت ظروف الاجهاد الحراري عيد محمد احمد زين الدين ، صبري ميرغني عثمان و عبد الرحمن ابراهيم السيد قسم الانتاج النباتي – مركز بحوث الصحراء

أجريت هذه الدراسة خلال موسمي 2016 و2017 علي اشجار النخيل البرحي عمر 10 سنوات النامية في مزرعة محطة البحوث التابعة لمركز البحوث الزراعية بتوشكا بهدف دراسة تأثير بعض المعاملات علي تحسين العقد والانتاجية تحت ظروف الاجهاد الحراري. حيث اجريت المعاملات الاتية: التلقيح بالطريقة التقليدية (الكنترول).-1 رش السوبات بالمحلول السكري بتركيز 4جم/لتر ماء ثم التعفير بحبوب اللقاح.2- رش السوبات بمخلوط حبوب اللقاح مع المحلول السكري بتركيز 4جم/لتر ماء. 3- رش السوبات بمحلول اليوراكس بتركيز 4جم/لتر ماء ثم التعفير بحبوب اللقاح.4- رش السوبات بمخلوط حبوب اللقاح مع محلول اليوراكس بتركيز 4جم/لتر ماء. 5- رش السوبات بمحلول نفتالين اسيتك اسيد بتركيز 0.5جم/لتر ماء ثم التعفير بحبوب اللقاح.6- رش السوبات بمخلوط حبوب اللقاح مع محلول نفتالين اسيتك اسيد بتركيز 0.5جم/لتر ماء. 7- اهم النتائج المتحصل عليها: 1- اظهرت كل المعاملات بخلاف الكنترول زيادة معنوية في نسبة العقد ونسبة الثمار المتبقية ومتوسط وزن السوباطة والمحصول بالإضافة للنخفاض المعنوي في نسبة التساقط في الثمار مقارنة بمعامل الكنترول وقد تفوقت معاملة رش السوبات بمحلول اليوراكس بتركيز 4جم/لتر ماء ثم التعفير بحبوب اللقاح علي باقي المعاملات المدروسة في كلا من موسمي الدراسة.2- اظهرت كل المعاملات زيادة معنوية في صفات الثمار الطبيعية المدروسة مثل متوسط وزن الثمرة واللحم بالجرام والنسبة المئوية للحم الثمرة واعطت معاملة رش السوبات بمحلول اليوراكس بتركيز 4جم/لتر ماء ثم التعفير بحبوب اللقاح زيادة معنوية في القيم في كلا موسمي الدراسة.3- اظهرت كل المعاملات زيادة معنوية في محتوى الثمار من السكريات الكلية والمختزلة وغير المختزلة وكذلك المواد الصلبة الذائبة الكلية كما اعطت انخفاضاً معنوياً في محتوى الثمار من الحموضة الكلية مقارنة بمعامل الكنترول وقد تفوقت معاملة رش السوبات بمحلول اليوراكس بتركيز 4جم/لتر ماء ثم التعفير بحبوب اللقاح عن باقي المعاملات في كلا من موسمي الدراسة. التوصية: من خلال النتائج السابقة يمكن التوصية برش سوبات نخيل البلح البارحي بمحلول اليوراكس بتركيز 4جم/لتر ماء قبل التعفير بحبوب اللقاح لتحسين عقد الثمار والانتاجية والصفات الطبيعية والكيميائية للثمار تحت ظروف الاجهاد الحراري.