American-Eurasian J. Agric. & Environ. Sci., 10 (1): 65-69, 2011
ISSN 1818-6769

Effect of Delaying Pollination on Bunch Weight and Fruit Quality of Barhy Date Palm Cultivar under Riyadh Condition.

R.S. Al-Obeed and S.S. Soliman

Department of Plant Production, College of Food and Agric. Sciences, King Saud Univ., KSA

Abstract: This study was conducted at the Agriculture Research and Experiment Station, Dirab, College of Food and Agricultural Sciences, King Saud University, Riyadh during two successive seasons, 2008 and 2009, to study the effect of delaying pollination on bunch weight and fruit quality. Pollination was achieved after spathe cracking (control), one, two, three and four weeks from female spathe cracking. Delaying Pollination to three weeks after spathe cracking resulted in a significant reduction in initial fruit set, fruit retention, bunch weight and improving the physical and chemical characteristics of dates. Pollination delay is found to be effective on fruit thinning tool. It is concluded that the three weeks of female spathe cracking is considered the maximum period of cultivar to obtain appropriate yield with good fruit quality of Barhy dates under this study conditions.

Key words: Barhy date palm · Delaying pollination · Yield · Fruit quality

INTRODUCTION

Date palm (*Phoenix dactylifera L.*) is one of the important fruit species grown in Kingdom of Saudi Arabia. Barhy is the best soft type date palm cultivar. It can grow well under drastic environmental conditions which may be unsuitable for many fruit species. Pollination is considered the most important factor affecting fruit set, yield and fruit quality. Pistils do not remain receptive for a long time and the period of receptivity differs with different weathering factors and cultivars [1, 2].Waked [3] reported that stigma was still ready to receive pollen grains for a period lasted to the second weeks from spathe opening, if the humidity was high and the temperature was moderate, but the ability to fertilization going to decline after the 8th day of spathe opening. In Iraq a study in Zafranea zone on 6 cultivars. Rahim [4] found that Zahedi date needs to pollinate through 10 days of spathe cracking to reach an economic yield. As for Kestawy and Sayer cultivars it's better to pollinate them not more than 15 days after spathe cracking, while Barhy and Kadrawy cultivars could be delayed the pollination up to 20 days after the spathe cracking to give an economic yield. The receptivity of female flowers reaches its optimum within three to four days after the spathe opening [5-11]. Others found this period is extended to be up to 5 days [12], 7 days [13], 7-12 days [14], 8-10 days [15], 9 days [16] and 10 days [17]. After pollination fourth to seventh days of spathe cracking is considered the maximum length of receptivity to give best yield and high fruit quality [5,7,9,10,18,19,].

Delaying pollination for many days significantly reduced fruit set, fruit retention and consequently bunch weight with improving fruit quality as compared to earlier immediate pollination for female spathe cracking [5, 10, 11].

The present study aimed to evaluate the appropriate length of period which the female flowers of Barhy date palm remain receptive to fertilization that resulted in appropriate fruit set, yield and fruit quality.

MATERIALS AND METHODS

This study was conducted at the Agriculture Research and Experiment Station, Dirab, College of Food and Agricultural Sciences, King Saud University, Riyadh during two successive seasons, 2007-2008 and 2008-2009. Fifteen Barhy date palm which are of uniform vigorous, 15 year-old and grown on sandy soil were selected. Only 8 bunches were left on each experimental palm. All cultural practices in the field for the experimental palms were carried out according to the applied schedule. Pollination was achieved by using pollen grains from only one male palm to avoid residues of metaxenia in both seasons. The palms were classified randomly into five delaying pollination treatments which were achieved after spathe

Corresponding Author: S.S. Soliman, Department of Plant Production, College of Food and Agric. Sciences, King Saud Univ., KSA

cracking "control", one, two, three and four weeks from female spathe cracking. Each treatment consisted of three replicates. Each date palm was considered as a replicate. Each spathe was bagged with a paper bag (before opining) to prevent contamination from other pollen grains. When first spathe cracking occurred, the date was written on the paper bag and considered as the starting date. After that, spathe pollination were applied in appropriate time period after one, two, three and four weeks from female spathe cracking and the paper bag was removed after fruit set (2 weeks) for each spathe. The experimental five treatments were arranged in a complete randomized block design.

The fruits were harvested at beser stage on the first weeks of August in both seasons and following characters were determined:

- Average bunch weight was estimated by kg.
- Initial fruit set percentage was recorded after two weeks from pollination.
- Fruit retained percentage: the average fruit retained percentage was calculated at harvest using the following this equation:

$$\text{Fruit retained \%} = \frac{\text{Total number of retained fruits per bunch}}{\text{Total nodes number per bunch}} \times 100$$

Fruit Physical Characters: Ten fruits were taken randomly from each bunch (replicate) to determine fruit volume and dimensions (fruit length and fruit diameter, in cm), fruit weight, fruit flesh weight and seed weight (in grams).

Chemical Properties: Chemical properties of fruits namely moisture content, total soluble solid (TSS %), fruit acidity and sugar content (reducing, non-reducing and total sugar) were determined according to A.O.A.C. [20]. The titrable acidity was calculated as citric acid according to Mawlood [21].

RESULTS AND DISCUSSION

Bunch Weight: Initial fruit set, ultimate fruit retention and bunch weight are considered as indices for date palm yield. Data presented in Table 1 indicated that, the initial fruit set, fruit retention and bunch weight were significantly affected by delaying pollination in both seasons. The control treatment showed significant reduction as compared to other treatments. The decrement rate of initial fruit set and fruit retention was corresponding with the delaying pollination to four weeks followed by three weeks from female spathe cracking as compared to other treatments and the control. The stigma drought induces fiasco of pollen grain germination and fertilization. These findings may be due to the shortage of initial fruit set as the effect of delayed pollination. Bunch weight was the lowest with delaying pollination for four weeks followed by three weeks from female spathe cracking as compared to other treatments and the control. Such reduction had been found advantageous to improve the fruit quality and to lighten the bunch weight to make it less compact and easier to handle as well as ensure adequate following year flowering. The results clearly indicate the increase rate of seedless fruits in spathe with delaying pollination to four weeks from female spathe cracking because delaying pollination until four weeks increased drought of stigma with increasing weight of fruit retained. Delaying pollination leads to natural thinning consequently increased from cell division and cell enlargement as well as the biosynthesis of carbohydrates concerning and proteins[11,22]. These results are in agreement with those reported by El- Kassas [23], El- Kassas and Mohamed [5], Abdallah *et al.* [8], Al-Wasfy [9], Samih [10] , Abdel-Galil *et al.* [11] Moustafa [18], Dammas [19] and El-Salhy *et al.* [24],they reported that delaying pollination improving the fruit physical and chemical properties.

Fruits Characteristics

Physical Properties: Concerning the fruit weight, flesh weight, fruit volume and fruit dimensions, data presented in Table 1 indicated that, there were significant differences between treatments in both seasons except fruit length in the second season. Delaying pollination to three weeks from female spathe cracking increment fruit dimensions as compared to the other treatments and the control. Increasing fruit weight, flesh weight, fruit volume and fruit dimensions were resulted from the delaying of pollination until three weeks from female spathe cracking, consequently improved the fruit traits. The effect of delaying pollination on reducing fruit set, resulted in reducing the fruit numbers per bunch. This reduction had been found advantageous to improve the individual fruit weight. In this study the three weeks from female spathe cracking is considered the optimum and maximum period of receptivity female flowers to obtain appropriate yield

Table 1: Mean values of bunch weight and Physical properties of Barhy date palm cultivar as affected by delaying pollination from female spathe cracking during 2008 and 2009 seasons

Treatments	Initial fruit set %	Fruit retention %	Bunch weight (kg)	Fruit weight (g)	Seed weight (g)	Flesh weight (g)	Fruit volume (cm)	Fruit Length (cm)	Fruit diameter (cm)
	----------2008 season----------								
Control	98.33	64.70	25.03	9.59	1.20	8.39	9.27	3.15	2.23
One week	75.27	60.93	19.41	12.30	1.22	11.08	12.03	3.30	2.42
Two weeks	52.63	48.07	14.83	12.44	1.27	11.17	12.20	3.48	2.43
Three weeks	42.80	32.90	12.53	14.52	1.24	13.29	14.50	3.48	2.46
Four weeks	50.20	32.93	13.13	13.70	1.36	12.46	13.17	3.47	2.44
LSD 0.05	3.35	1.58	4.35	0.97	0.10	1.10	1.36	0.08	0.08
Mean	63.85	47.91	16.99	12.51	1.26	11.28	12.23	3.38	2.40
	----------2009 season----------								
Control	99.33	76.33	26.13	12.23	1.29	10.94	11.67	3.43	2.97
One week	76.23	54.33	18.10	13.59	1.22	12.36	12.50	3.37	2.77
Two weeks	57.63	51.90	17.23	14.54	1.19	13.42	14.33	3.47	2.90
Three weeks	39.70	34.60	12.90	16.29	1.30	14.99	15.33	3.47	3.10
Four weeks	54.50	37.27	14.00	15.34	1.22	14.12	15.00	3.50	3.00
LSD 0.05	5.01	3.62	4.68	1.95	N.S	1.96	2.03	N.S	0.17
Mean	65.48	50.89	17.67	14.40	1.24	3.17	13.77	3.45	2.94

Table 2: Mean values of chemical properties of Barhy date palm cultivar as affected by delaying pollination from female spathe cracking during 2008 and 2009 seasons.

Treatments	TSS (%)	Reducing sugars (%)	Non-reducing sugars (%)	Total sugars (%)	Acidity %	Moisture content (%)
	----------2008 season----------					
Control	26.70	20.22	5.51	25.73	0.78	63.27
One week	29.70	19.94	7.05	26.98	0.82	62.94
Two weeks	31.07	20.72	6.16	26.88	0.88	61.67
Three weeks	33.60	21.47	6.76	28.23	0.78	60.20
Four weeks	28.80	16.30	9.53	25.83	0.83	62.91
LSD 0.05	1.98	1.47	2.95	2.19	0.103	N.S
Mean	29.97	19.73	7.00	26.73	0.82	62.20
	-*----------2009 season----------					
Control	25.00	17.77	6.43	24.20	0.71	64.83
One week	28.80	17.30	7.71	25.01	0.64	62.97
Two weeks	26.00	17.07	8.06	25.13	0.82	61.20
Three weeks	30.87	18.17	8.74	26.91	0.77	58.88
Four weeks	27.48	16.19	8.87	25.06	0.80	63.50
LSD 0.05	4.86	0.96	1.97	1.55	0.32	3.45
Mean	26.88	17.30	7.96	25.26	0.75	62.28

with the best physical fruit quality of Barhy date palm cultivar. These findings are supported by those achieved by Rahim [4], who found that Barhy and Kadrawy cultivars could be delayed the pollination up to 20 days after the spathe cracking to give an economic yield. Marzouk *et al.* [7], Abdallah *et al.* [8], Al-Wasfy [9], Samih [10], Abdel-Galil *et al.* [11] and Moustafa [18], found that delaying pollination significantly increased the fruit physical properties and improved fruit quality.

Chemical Properties: Result of total soluble solids, reducing sugars, non-reducing sugars, total sugars, total acidity and moisture contents percentage in the two seasons showed that those properties were significantly affected by delaying treatments in both seasons except fruit moisture contents in the first season (Table 2). The fruit total soluble solids, reducing sugars and total sugars percentage was increased by delaying pollination to three weeks from female spathe cracking in comparison with the other treatments and the control in both seasons. Delaying pollination until four weeks and two weeks from female spathe cracking resulted in a significant increase in the non-reducing sugars content and total acidity, respectively in comparison with the other treatments and

the control in both seasons. Whereas, moisture content percentage was significantly increased by the control as compared with other treatments in the second season. While delaying pollination to three weeks from female spathe cracking gave the lowest moisture content percentage in two seasons. Such results could be attributed to the effect of delayed pollination on reducing the fruit set and consequently reducing the fruit numbers per bunch. This had been found advantageous to supply adequate carbohydrate and other essentials of food for fruits to hasten the maturity which in turn improve the fruit quality. These results are in line with those obtained by El- Kassas and Mahmoud [5], Abdallah *et al.* [8], Al-Wasfy [9] Abdel-Galil *et al.* [11], Moustafa [18] and Abou Sayed-Ahmed [25].

In conclusion, results of the present study on Barhy date palm cultivar under conditions of Riyadh Governorate in Kingdome of Saudi Arabia clarified that delaying pollination until four weeks from female spathe cracking depressed the palm productivity probably due to insufficient assimilates for a good crop. Immediate pollination was suitable to increase the rate of initial fruit set and fruit retention, which may increase the risk of insects attack and diseases because of the fruit shading within compacted spathe. Also, decreased fruit weight, fruit volume and fruit color. The results indicated that delaying pollination until three weeks from female spathe cracking was the most suitable treatment to obtain lowest yield with good quality. Similar investigations are needed on other cultivars and localities to determine the appropriate delaying pollination conservation cultivars of compact spathe.

ACKNOWLEDGEMENTS

With sincere respect and gratitude, we would like to express deep thanks to President of Agriculture Research Center, College of Food and Agic.Sciences, King Saud Univ. for his financial support, inspiring guidance, sponsoring, encouragement, counsel, understanding and constructive criticism which have vitally contributed to this study. Also, many thanks for all staff members of Agriculture Research Center for kind advice, help, support and for their continuous energetic encouragement.

REFERENCES

1. Shaheen, M.A., 1986. Pistil receptivity in three cultivars of date palm (*Phoenix dactylifera* L*)*. Proc.1st Hot.Sci.Conf.Tanta Univ. Egypt. September, 11: 489-499.
2. Marzouk, H.M., A.M. El-Salhy and R.A. Hassan, 2002a. Effect of pollination of fruit set, yield and fruit quality of Zaghlool and Samany date palm cultivars. A- Evaluation of five seedling date palm males and their effect on yield and fruit quality. Proc. Minia 1st Conf. for Agric. and Environ. Sci. Minia, Egypt, 25-28: 983-998.
3. Waked, A., 1973. Date Anglo-Egyptian Bookshop, Cairo, (in Arabic).
4. Rahim, A.L., 1975. Studies on pollination palm date conference, Baghdad, 30 Nov.4-Dec.Abst. On the Date. FAO: Regional Project for palm and Date Research Center Baghdad, Iraq, pp: 31-32.
5. El-Kassas, SH.E. and H.M. Mahmoud, 1984. Receptivity of pistillate flowers of "Zaghlool" date palm grown in Upper Egypt. Assiut J. Agric. Sci., 15(1): 105-112.
6. Soliman, S.S., 1992. Effect of pollen source on fruiting and fruit characteristics of two date palm cultivars “Samani and Sakkoty”. Ph.D. Thesis, Fac. Agric. Cairo. Univ., pp: 1-200.
7. Marzouk, H.M., A.M. El-Salhy and R.A. Hassan, 2002b. Effect of pollination on fruit set, yield and fruits quality of Zaghlool and Samany date palm cultivars. B- Effect of male type and receptivity of pistillate flowers on fruit set, yield and some physical fruit properties. Proc. Minia 1st Conf. for Agric. and Environ. Sci. Minia, Egypt, 25-28: 999-1012.
8. Abdallah, A.S., S.S. Ebeed and M.S. Hammam, 2002. Pistillate receptivity of Sewy date palm flowers grown at El-Dakhla Oasis, New Valley. Proc. Minia 1st Conf. for Agric. and Environ. Sci., 25-28: 1765-1772.
9. Al-Wasfy, M.M., 2005. Studies on receptivity of pistillate flowers of Zaghlool and Haiany date palm cultivars under Qena conditions. Proceeding of Second Syrian Egyptian Conf. 25-28 April, Al-Baath Univ. Hams, Syria,
10. Samih, M., 2006. Determination of the best pollination time of Sayer date cultivar. Abstract of the Third International Date Palm Conf. Feb. 19 -21, Abu Dhabi.
11. Abdel-Galil, H.A., A.M. El-Salhy, A.Y. Abdalla, M.M. El-Akad and Y.M. Diab, 2007. Effect of delaying pollination on yield and fruit quality of Sewy date palm under New Valley condition in Egypt. Proceedings of the fourth Symposium on the date palm in Saudi Arabia, Al-Hassa, pp: 123.
12. Ahmed, S. and H.M. El-Shaikh, 1971. Receptivity of pistilite flowers in date palm. Punjab Frt. J. Lyallur, Pakistan, pp: 34242.
13. Gupta, M.R. and S.K. Thatai, 1980. Receptivity of pistillate flowers in date palm cv.Shamran. J. Res. Punjab Agric. Univ., 17(4): 366-368.

14. Stoler, S., 1972. Date pollination and fertilization. II-Fertilization. Hort. Abst., 42(2): 4905.
15. Pereau-Leroy, P., 1957. Flower fertilization in date palm. Hort. Abst., 27(3): 2812.
16. Al-Bajallani, A.N.R., A. Al-Attar and A.A. Mohammad, 1989. Effect of day-time pollination during ten days sapth splitting on fruit setting of (*Phoenix dactylifera* L. cv. Sukkari). Annals Agric. Sci. Fac. Agric. Ain Shams. Univ. Cairo, Egypt, 34(2): 1329-1345.
17. Ream, C.L. and J.R. Furr, 1969. The period of receptivity of pistillate flowers and other factors affecting set of date fruit. Rep. 46th Annu. Date Gr's Inst. Coachella, pp: 28-29.
18. Moustafa, A.A., 1998. Studying on pollination of date palms. The First International Conference on date palm. Al-Ain United Arab Emirates. March 8-10, pp: 39-48.
19. Dammas, M.O., 1998. Fruit growth and receptivity of pistillate flowers to pollination in two date palm cultivars (*Phoenix dactylifera* L.). M.Sc. Thesis, Fac. Meteorology, Environment and Arid land Agri. King Abdel Aziz Univ. K.S.A.
20. Association of Official Agricultural Chemists (AOAC) 1995. Official Methods of Analysis. A.O.A.C.15th Ed. Published by A.O.A.C. Washington, D.C. (U.S.A).
21. Mawlood, E.A., 1980. Physiological studies on fruits development of Samani and Zaghlool date palm cultivars. Ph.D. Thesis, Fac. Agric. Cairo. Univ.,
22. Elham, Z.A., M.F. Shahin and L.F. Hagagg, 2006. Response of Valencia Orange trees budded on troyer citrange and sour orange to foliar application of some macro and micronutrients. J. Appl. Sci. Res., 2(11): 952-965.
23. El-Kassas, S.H.E., 1983. Manual bunch and chemical thinning of "Zaghlool" dates. Assiut. J. Agric. Sci., 14(2): 221-233.
24. El-Salhy, A.M., A.Y. Abdalla and R.A.A. Mostafa, 1997. Evaluation of some date palm male seedlings in pollination of "Zaghlool" and "Samany" date palms under Assiut conditions. Assiut J. Agric. Sci., 28(2): 79-89.
25. Abou Sayed-Ahmed, T.A., 1993. Influence of inflorescence bagging and sequential delayed pollination on fruit set and major yield parameters of "Samani" soft date cv. Zagazig J. Agri. Res.m 20(2B): 863-871.