

Effect of Boron Spray and Pollination Methods on “Zahdi” Date Palm Yield and Fruits Quality

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ABSTRACT

This experiment was conducted in private orchard in Al-Hashemiyyah district in Babylon Governorate in 2020 season to study the effect of boron spraying and pollination methods on fruit quality characteristics and date palm yield on 25 years old of “Zahdi” cultivar. 42 homogeneous palm trees were selected, and they were implemented as a factor experiment (2×7). The treatments were distributed randomly according to a randomized complete design RCBD with three replications. One date palm was considered an experimental unit. The experiment included a study of two factors; the first is spraying with boron at two levels (B1, which is spraying boron at a concentration of 150 mg.L^{-1} in floral stage, and B0 without spraying). The second factor included pollination methods (manual pollination method, which is control (D_1), mechanical dry pollination with pollen with a concentration of 1g:5g of filler (D_2), and dry mechanical pollination with pollen at a concentration of 1g:7g of the filler (D_3), mechanical pollination with pollen grains at a concentration of 1 g.L^{-1} : 9 g of the filler (D_4), mechanical pollination with pollen grains at a concentration of 2 g.L^{-1} of water (S_1), and mechanical pollination with pollen grains at a concentration of 4 g.L^{-1} (S_2), A liquid with pollen with a concentration of 6 g.L^{-1} (S_3). wheat flour was used as a filler, and 5 g of starch was used as an aid for every liter of water. The results showed that, boron spray did not have significant effects on the studied characteristics in the experiment. Results also showed that the liquid mechanical pollination method (S_2), affected the quality characteristics of the fruits, gave the highest fruit weight of 8.60 g, and also highest fruit volume of 9.71 cm^3 . Also, Results showed that the dry mechanical pollination method (D_3) affected the yield as it gave highest bunch weight of 7.21 kg, and also gave highest yield per palm of 79.35 kg.

Keywords: Boron, Pollination Methods, Zahdi, Date Palm Yield

INTRODUCTION

Date Palm trees *Phoenix dactylifera* L. belongs to Arecaceae family and to the order Palme. The date palm is one of the oldest trees known to man, dating back to more than 4000 BC, and the Babylonians and Assyrians cared for it (Ibrahim, 2008). The date palm is suitable for dry and semi-arid areas, so its cultivation spread throughout the entire Arab world, starting from Mauritania to Arabian Gulf (Ibrahim, 2011). The number of date palm trees in Arab world is 86 million trees, and in Iraq about 1,513,907 trees, total area planted with palms in the world is about 135,315.9 hectares, while the cultivated area in Iraq in 2018 was about 76,400 hectares, while the global production of dates reached about 8,460,443 tons, of which 646.2 Thousand tons in Iraq (PCBS, 2018). There are 627 agricultural varieties of dates in

Iraq, of which about 50 are commercial (Al-Bakr, 1972). Zahdi dates constitute more than half of Iraq's production of dates, reason for this is due to the high productivity of the Zahdi palm, which ranges between 50 and 130 kg, as well as its tolerance to salinity, drought and frost, and it is a fast-growing tree in the Iraqi environment (Al-Aqidi, 2016).

Boron is one of the most important micro-nutrients necessary in increasing fruit set, cell division, producing pollen, increasing fertilization process, and reducing the rate of aborting eggs. As well as its role in the formation of carbohydrates and increasing the speed of their transition to the effective areas of growth in the reproductive stage of the plant, which positively affects the increase in fruit set (Wimmer and Eichert, 2013; Kayhan *et al.*, 2016). It is the most important vital functions of boron because it makes the transition of sugars in the plant easy and it stimulates the formation of phenolic and lignin, it has a role in the formation of cells and composition the nuclear acids DNA and RNA (Al-Hadethi *et al.*, 2019). Some studies have been conducted on the effect of boron spray on yield and fruit quality of date palm trees, Mostafa (2015) found a significant increase in bunch weight, fruit length, fruit diameter and fruit weight of “Zaghloul” date palm cultivar, when spraying boron at 2000 mg.L^{-1} . Zean El-Dean *et al.* (2017) also found that boron spray as compared with control treatment, resulted in an increase in fruit set, remaining fruit percentage, bunch weight, fruit length, fruit diameter and fruit weight of ten year's old trees of “Barhee” date palm cultivar, when spraying borax at 400 mg.L^{-1} .

Pollination represents the largest part of date palm service operations, and pollination must be done artificially, which is either manually or mechanically. Historical studies have indicated that artificial pollination in date palms has been practiced since the early ages, as mentioned in cuneiform paintings dating back to the last section of third millennium BC in Mesopotamia, and the process of artificial pollination is one of the Sumerian rituals, and there are Assyrian inscriptions explaining this (Ibrahim, 2019). Several studies have been conducted on date palm pollination, Awad (2010) explained in his study on “Khenazy” date palm that pollination was carried out using an aqueous suspension containing (0.5, 1, 1.5, 2) g.L^{-1} of pollen compared to manual pollination method, results showed the superiority of manual pollination method significantly in increasing fruit weight when compared to the method of pollination using the aqueous suspension. Bashir *et al.*, (2012) studied the effect of pollination using different ratios of the carrier substance (wheat flour) with pollen on “Aseel” date palms at 2:1, 4:1, and 8:1 and pure pollen using hand dust, and concluded that fruit size and weight was not affected by the different treatments. Due to few of studies on the mechanization of pollination process, reducing costs and reducing the amount of pollen used, the study aimed to test the different methods of pollination, whether it was fogging or spraying, and determine the efficiency of each of them compared to manual pollination.

MATERIALS AND METHODS

This experiment was conducted in private orchard in Al-Hashemiyyah district in Babylon Governorate in 2020 season to study the effect of boron spraying and pollination methods on fruit quality characteristics and date palm yield on 25 years old of “Zahdi” cultivar. 42 homogeneous palm trees were selected, and they were implemented as a factor experiment (2×7). The treatments were distributed randomly according to a randomized complete design RCBD with three replications. One date palm was considered an experimental unit. The experiment included a study of two factors; the first is spraying with boron at two levels (B1, which is spraying boron at a concentration of 150 mg.L^{-1} in floral stage, and B0 without spraying). The second factor included pollination methods (manual pollination method, which is control (D_1), mechanical dry pollination with pollen with a concentration of 1g:5g of filler (D_2), and dry mechanical pollination with pollen at a concentration of 1g:7g of the filler (D_3), mechanical pollination with pollen grains at a concentration of 1 g.L^{-1} : 9 g of the filler (D_4), mechanical pollination with pollen grains at a concentration of 2 g.L^{-1} of water (S_1), and mechanical pollination with pollen grains at a concentration of 4 g.L^{-1} (S_2), A liquid with pollen with a concentration of 6 g.L^{-1} (S_3). wheat flour was used as a filler, and 5 g of starch was used as an aid for every liter of water. The following parameters were determined in the two successive seasons:

1. Fruit weight (gm): Samples consists of 10 fruits were randomly selected from treated tree, were determined and recorded at the peak of the “date” stage.
2. Fruit volume (cm^3): fruit size was calculated by calculating the amount of displaced water resulting from immersion of 20 fruits in a graduated cylinder, as a known volume of water was placed in it and then the fruits were submerged, The volume was measured by finding the difference between the water level in both cases, and then extracted the volume of one fruit by dividing the total volume of fruits by the number of fruits.
3. Bunch weight (kg): bunch weight average was calculated for each palm by dividing the total amount of each treatment by bunch number (11 bunch).
4. Yield per palm (kg): Total yield per tree in study season was determined by harvesting all bunches from each tree and the weights were recorded in kilogram.

The obtained results were subjected to analysis of variance according to (Elsahookie and Wuhaib, 1990) using L.S.D 0.05 for comparing differences between various treatment means.

RESULTS AND DISCUSSIONS

Effect of Boron Spray and Pollination Methods on Fruit Weight, Fruit Volume, Bunch Weight and Yield per Palm: Data concerning the effect of treatments on fruit weight, fruit volume, bunch weight and yield per palm are listed in Table (1). The data cleared that, Spraying with boron did not have significant effects on the studied

characteristics in the experiment. Table (1) also shows that the liquid mechanical pollination method (S_2), affected the quality characteristics of the fruits, gave the highest fruit weight of 8.60 g, and also highest fruit volume of 9.71 cm³. Also, the lower values of these traits were in manual pollination method (D_1). Results showed that the dry mechanical pollination method (D_3) affected the yield as it gave highest bunch weight of 7.21 kg, and also gave highest yield per palm of 79.35 kg. The interactions between boron spray and pollination methods significantly affected in all studied traits especially the interaction treatment (B_1D_3) gave a significant effect in bunch weight it's gave 7.45 kg, and also in yield per palm, as it gave the highest weight of 82.00 kg.

Table (1) Effect of Boron Spray and Pollination Methods on “Zahdi” Date Palm Yield and Fruits Quality

Fruit weight (gm)				Fruit volume (cm ³)		
Pollination	Boron spray (B)			Boron spray (B)		
	0	150	mean	0	150	mean
D_1	7.44	7.95	7.70	7.67	8.33	8.00
D_2	8.62	8.08	8.35	10.17	8.58	9.38
D_3	8.04	8.39	8.22	8.58	9.08	8.83
D_4	7.90	7.91	7.91	8.83	9.25	9.04
S_1	7.99	8.56	8.28	9.17	9.50	9.34
S_2	8.46	8.73	8.60	9.50	9.92	9.71
S_3	8.15	8.21	8.18	8.92	9.58	9.25
mean	8.09	8.26		8.98	9.18	
L.S.D 5%	B	P	Int.	B	P	Int.
	N.S	0.74	1.05	N.S	0.95	1.34
bunch weight (kg)				yield (kg)		
D_1	6.67	6.68	6.68	73.40	73.50	73.45
D_2	5.16	5.75	5.46	56.80	63.20	60.00
D_3	6.97	7.45	7.21	76.70	82.00	79.35
D_4	6.97	6.69	6.83	76.70	73.60	75.15
S_1	6.24	5.50	5.87	68.60	60.30	64.45
S_2	5.87	4.69	5.28	64.60	51.60	58.10
S_3	6.41	5.78	6.10	70.50	63.60	67.05
mean	6.33	6.08		69.60	66.80	
L.S.D 5%	B	P	Int.	B	P	Int.
	N.S	1.29	1.82	N.S	14.13	19.98

The reason for the superiority of liquid pollination method (S_2) by giving it a higher fruit volume and weight than manual pollination is due to the low percentage of fruit set in it, so there is less competition between the fruits to obtain food, and then the maximum benefit in increasing their volume and weight (Ahmed, 2018). Superiority of dry automatic pollination method (D_3) and manual pollination (D_1) compared with liquid pollination method (S_2) is due to that S_2 treatment has the lowest fruit set rate

among other pollination methods and the highest drop rate. Therefore, what happened to her was tantamount to performing a thinning operation (Ahmed, 2018). These results are in agreement with those obtained by (Awad, 2006) on 'Lulu' date palm trees, and Iqbal et.al (2010) on "Dhakki" date palm cultivar.

REFERENCES

1. Ahmed, I. F. S .2018. Studies on Pollination in Saidi Date Palms with Different Techniques under the Conditions of Kharga Oasis . Fourth Egyptian Dates Festival, Siwa.7-9/11/2018.
2. Al-Aqidi, H. K .2016. Varieties of Iraqi dates, Al-Zahdi cultivar, the Iraqi network for the date palm.
3. Al-Bakr, A. 1972. The date palm: its past, present and new in its cultivation, industry and trade - Al-Ani Press, Baghdad - Iraq.
4. Al-Hadethi, Mustafa. E.A; U.Y.Salih , S. H. J. Al- Hgemi and Ahmed. O.J, Janabi. 2019. Effect of boron and gibberellins spray on leaves chemical content in olive trees. Int. J. Agricult. Stat. Sci. 15(1): 237-241.
5. Awad, M.A.2006. Water spray as a potential thinning agent for date palm flowers (Phoenix dactylifera L.) c.v. 'Lulu'. Scientia Horticulturae 111(1): 44 – 48.
6. Awad, M.A.2010.Pollination of date palm (Phoenix dactylifera L.) cv. Khenazy by pollen grain-water suspension spray. Journal of Food, Agriculture & Environment. 8 (3&4): 313 – 317.
7. Bashir,M.A.,M.Ahmed,M.I.Khan, and F. Altaf. 2012. Toeconomise date palm pollens through different materials in Aseel Cv.Sarhad J. Agric.28 (2): 197- 200.
8. Central Organization for Statistics and Information Technology (PCBS). The Ministry of Planning and Development Cooperation. Report production of summer fruit trees for the year 2019. Baghdad. Iraq.
9. Elsahookie,M.M and K.M, Wuhaib. 1990. Design and Analysis of experiments. Univ. Of Bagh. Dar al hekma.pp.488.
10. Ibrahim, A.O. 2008. Date palm tree of life. The Arab Center for Studies of Arid Zones and Dry Lands (AKEED), Damascus. Syria. 19- 217 p.
11. Ibrahim, A.O. 2011. The reality of palm cultivation and date production in the Arab world, Studies, Planning and Statistics Department (ACSAD).
12. Ibrahim, A.O. 2019. Palm cultivation and the quality of dates between environmental factors and service and care programs. Khalifa International Award for Date Palm and Agricultural Innovation Conference.
13. Iqbal, M.M.Q.Khan, M . Munir, S.Rehman, H. Rehman, and. M. Niamatullah .2010. Effect of different pollination techniques on fruit set, pomological characters and yield of Dhakki date palm (Phoenix dactylifera L.) in Dera Ismail Khan, KP. Sarhad J. Agric.26 (4):515-518.
14. Kayhan, D.S., C. Kayhan and Y.O. Ciftci. 2016. Excess boron responsive regulations of antioxidative mechanism at physio-biochemical and molecular levels in Arabidopsis thaliana. Plant Physiol. Biochem. 109: 337-345.

15. Mostafa, R.A.A. 2015. Effects of Zinc, Boron and Active Dry Yeast Sprays on Yield and Fruit Quality of Zaghloul Date Palm. Arab Univ. J. Agric. Sci., 23 (2): 467-473.
16. Wimmer, M.A. and T. Eichert. 2013. Review: Mechanisms for boron deficiency-mediated changes in plant water relations. Plant Sci. 203-204: 25-32.
17. Zaen EL-Daen, E. M. A.; EL-Merghany, S. and Abd EL-Rahman, I. E. 2017. Improving Fruit Set and Productivity of Barhee Date Palm under Heat Stress Conditions. J. Plant Production, Mansoura Univ. 8 (12): 1403- 1408.