Impact the spraying of pollen suspension with sorbitol and atonik and traditional pollination methods on the growth characteristics of date palm cultivars Maktoum and Braim

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Abstract

In 2023, we conducted this study in one of the orchards of Al-Wajihiyah district, in the village of Sinija in Divala governorate, to evaluate the effects of traditional pollination methods and the spraying of fortified pollen suspension with sorbitol and Atonik on the growth characteristics of date palm cultivars Maktoum and Braim. The two cultivars of date palms, 50 years old, were propagated using the offshoots method. On April 1, 2023, we pollinated the trees with the semisimi cultivar, selecting 24 palm trees from both cultivars. We considered each palm tree an experimental unit, resulting in a total of 48. We designed the experiment as a factorial experiment using a randomized complete block design (RCBD), which included two factors: the female cultivars as the first factor, and the spraying of sorbitol at concentrations of 5 and 10 g L-1 and Atonik at concentrations of 1 and 2 ml L-1 as the second factor. We conducted the spraying process on April 10, 2023, and sampled the fruit at the date stage. The results demonstrated the superiority of the Braim cultivar over the Maktoum cultivar in terms of fruit set percentage, fruit size and weight, and cluster weight. Spraying with sorbitol at a concentration of 10 g L-1 led to the highest average in the fruit set, fruit size, and weight of the cluster. The treatment of spraying with a tonic at a concentration of 2 ml L-1 led to the highest average in the size and weight of the fruit and the weight of the cluster. The interaction treatment between sorbitol at a concentration of 10 g L-1 and a tonic of 2 ml L-1 was characterized by the highest values of the percentage of fruit set, size and weight of the fruit, and weight of the cluster.

Keywords: Date palm, sorbitol, Atonik

Introduction

Date palm belongs (Phoenix dactylifera L.) to the Arecaceae family and to the order of Palmae, and this family is one of the oldest families of vascular plants flowering in monocotyledons and includes more than 200 genera and approximately 400 species. The date palm is a dioecious tree, and monosexual (unisexual) is cultivated in Iraq. It is widespread in areas between latitudes 10–30° north of the equator and extends to 20° south of the equator [12,13]. The estimated production of dates for the season 2020, including all cultivars , was 735.4 thousand tons, an increase of 15% over the estimated production of the previous year, which was estimated at 639.3 thousand tons. The province of Baghdad ranked first in terms of production, with an estimated 126.2 thousand tons produced by 17.2% of Iraq's total production, a decrease of 6.7% from the estimated 135.2 thousand tons produced last year. The province of Babylon came in second, with an estimated 117.9 thousand tons produced by 16.0% of the country's total production, a rise of 26%, and Divala province came in third, with an estimated production of one thousand tons by 12% of the total production of Iraq, as opposed to the rest of the of the provinces, which made up 54.8% of Iraq's overall production [5]. Sorbitol C6H14O6 is one of several types of alcoholic sugars, numbering more than seventeen species, found in high-end plants, and is the main and final product of photosynthesis. The presence of sorbitol is important in the plant's response to abnormal conditions and stresses such as salinity. drought. and low temperatures [11]. Atonik is easily absorbed by the plant organs, increasing the flow of plant sap, giving additional strength and vitality to plant cells, as it works to improve seed germination when soaked with its solution, increasing fruit production, improving pollen germination, and increasing the fruit quality. It is of great importance in reducing the fall of flowers and fruits as well as helping early production, and it can be mixed with pesticides, fungicides, and foliar fertilizers [1]. Pollination is one of the most agricultural practices important in the cultivation of date palms, without which it is difficult to obtain the yield of the required quality. Date palm pollen has a great impact on the quality of fruits, their development, and productivity, and they are widely affected by the structure of pollen, vitality, and the ability to germinate under commercial agriculture. Farmers also need to manage pollen by storing it at a cold temperature and mixing it with various auxiliary substances to dilute the amount of used pollen grains in pollination. The success of pollination is also influenced by female flowers and their acceptance, so the right time is required to observe the time of female flowering [24]. The study aimed to evaluate the effect of traditional pollination methods and the spraying of fortified pollen suspension with sorbitol and Atonik on the growth characteristics of date palm cultivars Maktoum and Braim

Materials and Methods

A field experiment was carried out in Diyala Governorate, Al-Wajihiyah district, Sinija village during the season 2023, to determine the response of the two cultivars of date palm, Maktoum and Braim, to the traditional pollination methods and spraying pollen extract that supported with sorbitol and Atonik, and the two palm cultivars were 50 years old and propagated using vegetative propagation method with offshoots, as 24 palm trees of both cultivars were selected and homogeneous as possible in their growth and free of insect and disease infections to conduct treatments on them and divided into three sectors, in each sector 8 palm trees, some physical and chemical properties of the orchard soil were analyzed before the experiment was carried out in the Diyala Agriculture Department, where the samples were taken at a depth of 30-60 cm (Table 1). We carried out the orchard service process, which involved pruning trees, removing dry fronds, removing bushes, and hoeing the surface layer surrounding the roots. On April 1, 2023, we pollinated the Simesmi cultivar by selecting ten clusters for each palm tree and then installing them. We started harvesting fruits from September 15, 2023, until October 15, 2023, and collected fruit samples during the date stage for study analysis.

Experiment treatments

The experiment included eight treatments that resulted from an interaction between two factors. The female cultivars , such as Maktoum and Braim , were the first factor. The second factor included spraying with sorbitol at two concentrations, as well as Atonik at two concentrations, after the fruit flowering process on April 10, 2023 (Table 2.(

рН	K ₂ CO ₃	N	Р	K	Organic matter	Soil texture	Sand	silt	clay
		mg / k	g ⁻¹		ml/kg ⁻¹		%	%	%
7.54	199.2	28	3.48	198.2	5.8	Loam	378	450	148

Table 1. Chemical properties of orchard soil

Table 2. The experiment's treatments

Т	Symbols	Treatments
1	T1	Pollination in the traditional way
2	T2	Pollination with pollen suspension of the selected cultivar is pollen
		aqueous solution with distilled water at 5 g/L
3	T3	Pollen + Sorbitol 5g L^{-1}
4	T4	Pollen + Sorbitol 10 g L^{-1}
5	T5	Pollen + Atonik 1 ml L^{-1} (Growth regulater)
6	T6	Pollen + Atonik 2 ml L^{-1}
7	T7	Pollen + Sorbitol 5 g L^{-1} + Atonik 1ml L^{-1}
8	T8	Pollen + Sorbitol 10 g L^{-1} + Atonik 2ml L^{-1}

Sorbitol = Alcoholic sugar, Atonik = Growth regulator

The

studied

characteristics

On August 15, 2023, during the harvesting process, we collected fruit samples.

Percentage of fruit set(%)

We randomly selected twenty clusters, then calculated the number of set fruits, the number of fallen flower sites from each cluster, and the number of inedible fruits. The fruit set percentage is calculated using the following equation[21.[

Percentage of set fruit = Number of set fruit/ Number of set fruit + number of inedible fruits + number of fallen flower sites x100 Fruit size (cm3 (

We used the displaced water method, which involves placing a known volume of water in a graduated cylinder. We then placed 25 fruits in the cylinder and calculated the volume by comparing the water levels in the two cases [2.]

Fruit weight (g(

We randomly selected 25 fruits from each fruit cluster at harvest time. We weighed them with a sensitive balance and extracted the average weight of each fruit by dividing the weight of the selected fruits by their number.

Cluster weight (kg(

We calculated it by dividing the total yield by the number of clusters per palm tree.

Statistical analysis

The data were analyzed according to Duncan's multinomial test at a probability level of 0.05 [3.[

Results and Discussion

Percentage of fruit set (%)

The results in Table 3 demonstrated the superiority of the cultivar Braim, which had the highest percentage of fruit set (76.76%), compared to the cultivar Maktoum, which had the lowest percentage (75.09%). It also shows the superiority of the treatment with Pollen + Sorbitol 10 g + Atonik 2 ml, which gave the highest percentage of fruit set amounting to 81.28%, compared to the treatment with Pollination in the traditional way, which gave the lowest percentage of 70.61%. During the interaction between the treatments, the Braim cultivar, treated with Pollen + Sorbitol 10 g + Atonik 2 ml recorded the highest fruit set, reaching 82.05%, compared to the Maktoum cultivar and pollination in the traditional way, which amounted to 70.48%.

Fruit size (cm3(

The results in Table 4 demonstrated the superiority of the Braim cultivar in recording the highest value in fruit size (6.69 cm3), compared to the cultivar Maktoum, which had the lowest value (6.45 cm3). It also shows the superiority of Pollen + Sorbitol 10 g + Atonik 2 ml, which gave the highest value in fruit size amounting to 8.40 cm3 compared to the pollination in the traditional way, which gave the lowest value of 5.33 cm3. During the interaction between the treatments, the Maktoum and Braim cultivars treated with Pollen + Sorbitol 10 g + Atonik 2 ml recorded the highest value in fruit size, reaching 8.66 and 8.13 cm3, respectively, compared to the Maktoum cultivar and pollination in the traditional way, which amounted to 4.67 cm3. Fruit weight rate (g(

The results in Table 5 demonstrated the superiority of the Braim cultivar in recording the highest value in fruit weight (14.49 g), compared to the cultivar Maktoum, which had

the lowest value (12.87 g). The treatment of Pollen + Sorbitol 10 g + Atonik 2 ml showed an increase in fruit weight amounting to 17.45 g compared to the pollination in the traditional way, which gave the lowest value of 11.23 g. During the interaction between the treatments, the Maktoum and Braim cultivars treated with Pollen + Sorbitol 10 g + Atonik 2 ml recorded the highest value in fruit weight, reaching 17.84 and 17.06 g, respectively, compared to the Maktoum cultivar and pollination in the traditional way, which amounted to 11.01 g.

Cluster weight (kg(

According to the results in Table 6, the Braim cultivar was superior in recording the highest value in cluster weight, 23.08 kg, compared to the cultivar Maktoum, which had the lowest value, 21.33 kg. The treatment of Pollen + Sorbitol 10 g + Atonik 2 ml showed an increase in cluster weight amounting to 26.17 kg compared to the pollination in the traditional way, which gave the lowest value of 18.17 kg. As for the interaction between the treatments, the Braim cultivar treated with Pollen + Sorbitol 10 g + Atonik 2 ml recorded the highest value in cluster weight, reaching 27.33 kg, compared to the Maktoum cultivar and pollination in the traditional way, which amounted to 17.00 kg.

The results from the tables indicated that the pollination treatment in the Maktoum cultivar was significantly superior. This is attributed to the role of pollination in the production of food and non-food crops, and thus makes pollination economically important for agriculture and global food security, because it affects crops [9], as pollination works to transmit pollen grains from the anther (male floral organ) to the stigma (female floral organ), thus germinating the pollen grain and fertilizing the flower egg, making it possible

to produce seeds and fruits [6,7] and to improve crop productivity and quality [10]. The results from the tables also showed a significant superiority of the sorbitol treatment at a concentration of 10 g L-1. [16] attribute this to sorbitol's role in influencing stamen development, pollen tube growth, and resistance response. It also regulates many aspects of plant growth and development. Recently referred to as plant growth regulators similar to plant hormones [17], The results significant superiority in showed most physical traits. The reason may be attributed to the method of applying foliar nutrition, as plant minerals are dissolved in a solution and sprayed directly on the leaves of plants, thus improving fruit quality and productivity in a cultivar of horticultural crops [19]. This method has compensated for the deficiency in microelements, including nitrogen, and also affects the fruit's productive performance [20]. of adding Atonik The results at a concentration of 2 g L-1 also showed significant superiority in most of the studied traits. This may be due to the role of Atonik, which positively affects the various processes that control plant growth, development, and productivity, as plants treated with tonic are more advanced in growth and development. It also increases the intensity of the photosynthesis process and the rate of transpiration, in addition to its positive effects under adverse that are more evident

conditions, as it plays a protective role against various abiotic stresses, such as low or high temperatures, drought, heavy metals, and salinity [4]. The reason may be due to the active substances present in Atonik that work to increase plant growth, as plants absorb and stimulate stimulants quickly the protoplasmic flow of cells, accelerating germination and rooting. Application of the stimulant may increase the permeability of cell walls, which enhances the absorption of the nutrients that make up chlorophyll, which are very essential in the process of photosynthesis [15]. It also has great importance in influencing the physiology and morphology of it can directly as affect plants, the characteristics of the plant's root, vegetative and flowering growth, flowering life. obtaining a greater number of flowers, and enhancing or delaying flowering [8]. It also ensures plant metabolic balance, improves vitality, and provides high resistance against plant pathogens and pest attacks, as well as increasing the ability to withstand abiotic stresses [18]. This may be attributed to the addition of sorbitol, which led to an increase in size and weight and the weight of the cluster, and this is consistent with [23,14,22.] Conclusion

Spraying palm trees (Braim cultivar) with sorbitol (10 g/L) and Atonik (2 ml/L) significantly improved fruit growth parameters compared to other treatments

Treatments	Cultivars		Treatments average
	Maktoum	Braim	
Pollination in the traditional way	70.48	70.74	70.61
	g	g	Е
Pollen + distilled water	70.79	72.74	71.86
	g	fg	Е
Pollen + Sorbitol 5g L^{-1}	73.52	75.57	74.55
	ef	de	D
Pollen + Sorbitol 10 g L^{-1}	74.67	76.19	75.43
	de	cd	CD
Pollen + Atonik 1 ml L^{-1}	75.35	78.96	77.16
	de	b	BD
Pollen + Atonik 2 ml L^{-1}	76.19	78.02	77.11
	cd	bc	BC
Pollen + Sorbitol 5 g L^{-1} + Atonik	78.94	79.80	78.60
$1 \text{ml } \text{L}^{-1}$	b	b	В
Pollen + Sorbitol 10 g L^{-1} + Atonik	80.50	82.05	81.28
$2 \text{ml } \text{L}^{-1}$	b	a	А
Cultivars average	75.09	76.76	
	В	А	

Table 3. Effect of cultivars	and pollination treatments of fortified pollen suspension with	L
sorbitol and Atonik and their	interaction on the percentage of fruit set of date palm.	

Table 4. Effect of cultivarsand pollination treatments of fortified pollen suspension withsorbitol and Atonik and their interaction on fruit size of date palm

Treatments	Cultivars		Treatments
	Maktoum	Braim	average
Pollination in the traditional way	4.67	6.00	5.33
	e	bcde	С
Pollen + distilled water	6.20	5.80	6.00
	bcd	cde	С
Pollen + Sorbitol 5g L^{-1}	6.46	6.33	6.40
	bcd	bcd	BC
Pollen + Sorbitol 10 g L^{-1}	5.88	6.06	5.97
	cde	bcde	С
Pollen + Atonik 1 ml L^{-1}	5.53	7.33	6.43
	de	abc	BC
Pollen + Atonik 2 ml L^{-1}	6.20	6.40	6.30
	bcd	bcd	С
Pollen + Sorbitol 5 g L^{-1} + Atonik	8.00	7.56	7.40

$1 \text{ml } \text{L}^{-1}$	a	ab	В
Pollen + Sorbitol 10 g L^{-1} + Atonik	8.66	8.13	8.40
$2 \text{ml } \text{L}^{-1}$	а	a	А
Cultivars average	6.45	6.69	
	В	А	

Table 5. Effect	ct of cultivars	and pollination	treatments of	of fortified	pollen	suspension	with
sorbitol and A	tonik and their	interaction on th	e fruit weight	t of date pal	m		

Treatments	Cultivars		Treatments
	Maktoum	Braim	average
Pollination in the traditional way	11.01	11.44	11.23
	h	h	F
Pollen + distilled water	12.76	11.62	12.19
	g	h	Е
Pollen + Sorbitol 5g L^{-1}	13.98	13.46	13.73
	fg	ef	D
Pollen + Sorbitol 10 g L^{-1}	15.20	15.54	15.37
	cd	cd	BC
Pollen + Atonik 1 ml L^{-1}	13.94	16.06	15.01
	ef	abc	С
Pollen + Atonik 2 ml L ⁻¹	14.70	16.18	15.45
	de	abc	BC
Pollen + Sorbitol 5 g L^{-1} + Atonik	16.56	16.42	16.99
$1 \text{ml } \text{L}^{-1}$	ab	ab	В
Pollen + Sorbitol 10 g L^{-1} + Atonik	17.84	17.06	17.45
$2 \text{ml } \text{L}^{-1}$	a	а	A
Cultivars average	12.87	14.49	
	В	А	

Treatments	Cultivars		Treatments
	Maktoum	Braim	average
Pollination in the traditional way	17.00	19.33	18.17
	g	fg	D
Pollen + distilled water	19.33	22.67	21.00
	fg	bcde	С
Pollen + Sorbitol 5g L^{-1}	22.00	20.67	21.33
	cdef	ef	BC
Pollen + Sorbitol 10 g L^{-1}	21.67	24.33	23.00
	def	bcd	В
Pollen + Atonik 1 ml L^{-1}	22.33	22.33	22.33
	bcde	bcde	BC
Pollen + Atonik 2 ml L^{-1}	21.67	23.33	22.50
	def	bcde	BC
Pollen + Sorbitol 5 g L^{-1} + Atonik	21.67	24.67	23.17
$1 \text{ml } \text{L}^{-1}$	def	bc	В
Pollen + Sorbitol 10 g L^{-1} + Atonik	25.00	27.33	26.17
$2 \text{ml } \text{L}^{-1}$	ab	а	А
Cultivars average	21.33	23.08	
	В	А	

Table 6. Effect of cultivarsand pollination treatments of fortified pollen suspension withsorbitol and Atonik and their interaction on the cluster weight of date palm

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