

## The effect of pollination with different sources of pollen and spraying with calcium on the physical characteristics of palm trees, Barhi cultivar

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### Abstract

An assay performed in Diyala Province, Baqubah District in one of the private orchards during the season 2023 to determine the effect of the inoculated cultivar and spraying with calcium on some physical traits of the Barhi cultivar. An experiment included nine treatments outputted from factorial experiment with two factor. The first is pollinated cultivar, yellow ganami (A1) and red ganami (A2), pollen mixture (red + yellow) (A3). The second factor is spraying calcium at 1000 mg/L and 2000 mg/L. The findings revealed that the pollination type had a great effect on most of the physical characteristics. The mixed pollen cultivar (red ganami + yellow ganami) excelled in giving the best results for fruit size, fruit weight, seed weight, and total yield. Calcium spraying gave a significant effect on most characteristics; 2000 mg/L excelled in giving great values for the same characteristics. Likewise, the interaction between the pollination type and spraying with calcium had a great impact on most of the characteristics. The interaction between the cultivars (red ganami + yellow ganami) and spraying with 2000 mg/L of a calcium element gave the best results for previous characteristics.

**Keywords:** Date palm, ganami, calcium

### Introduction

Palm trees return to the family Arecaceae and order Palmae [16]. It is successfully cultivated in the subtropical and tropical regions of South Africa and Asia and has a high nutritional value. Date palms contain various biologically active compounds and have medicinal benefits. It was found that date seeds are effective in resisting *Staphylococcus aureus* and *Escherichia coli* bacteria. Leaves of palm have impacts on reducing blood sugar by inhibiting alpha-amylase and alpha-glucosidase [11]. Worldly, Iraq is considered the oldest place for the cultivation of palms, as nearly 600 cultivars are grown there, and date palms are mentioned in 22 verses in the Holy Qur'an [1]. There are more than 30 million palm trees planted in Iraq, but the number of

palm trees has become low in the past decades by 50%, as it fell to less than 16 million due to wars, the migration of villages, and water scarcity [4]. Pollination have a main role in palm production, and it is necessary for 75% of global crop species, which helps in the achievement of agricultural economics, and global food security [9]. Pollinator numbers are globally reducing due to many factors, including exposure to pesticides, diseases, and climate change. Decreased pollination results in lower yields and fruit, seed quality, and potential impacts on biodiversity and ecosystem performance [6]. Since palms are dioecious and unisexual, choosing an effective pollinator that carries a large amount of high-quality pollen is essential. Pollen and

pollination are among the most important factors that affect fruit set and yield because they are responsible for obtaining the appropriate yield in quantity and quality. As the use of a pollen cultivar compatible with the female cultivar leads to obtaining a high quantity yield [17]. Calcium (Ca) is the third most important nutrient for the plant. Its absorption is limited in the plant itself and it is an immobile element, which reduces its effect on the fruits [12]. It is the nutrient responsible for maintaining plant quality and fruit production. Calcium sources such as microcalcium (CaM) and complex calcium (CaC), and their supplementation provide a high-quality yield in palm cultivation and is a nutrient that greatly influences the cell formation of membranes, biomass production and cell walls of the plant. Calcium plays a role in meiotic of cell division, and in the structure and stability of chromosomes. Calcium also plays a activating role in some enzymes. Calcium is also necessary for the absorption of nitrogen in the form of nitrates. Sugars and starches accumulate in plants growing in an environment poor in calcium, and they are unable to absorb nitrate nitrogen. Nitrates appear in a short time when fertilizing with calcium, and most of the calcium in the plant accumulates in the leaves [14]. Foliar spraying of nutrients such as calcium leads to increased fruit set, reduced fruit drop, and high production in addition to quality [3]. Given that the date palm is dioecious, choosing an effective pollinator that carries a large amount

of high-quality pollen is necessary to obtain a high-quality yield. The assay aimed to evaluate the impact of inoculated cultivars and calcium spraying on some physical traits of the date palm, Barhi cultivar .

#### Methods and Materials

This assay was conducted in Diyala Province / Baqubah region in one of a private orchards during the season 2023 to determine the impact of the inoculated cultivar and spraying with calcium on some physical characteristics of the Barhi date palm cultivar. 10-year-old palm trees were used, propagated by vegetative propagation using cuttings and irrigated with an irrigation canal. 27 palm trees were selected due to their being free of insect and disease infestations and homogeneous in growth. Identification signs were placed on it, and it contains three plots, each containing nine trees. some properties of the soil were analyzed in the Wahaj Al Nakheel Laboratory (Table1). The study involved nine treatments that outputted from factorial experiment with two factor: the first was the pollinated cultivars: yellow ganami (A1), red ganami (A2), and the pollen mixture (red + yellow) (A3). The second consist of water spraying (B1), spraying with calcium 1000 mg/L (B2), and spraying with calcium 2000 mg/L (B3). Calcium was sprayed before the fruit setting process on 4/16/2023, the second on 4/30/2023, two weeks after the first spray, and the third on 5/21/2023, three weeks after the second spray.

**Table 1. The properties of the orchard soil before implementing the experiment**

Characteristics		Units	Value
pH		-----	7.01
Available nutrients	Nitrogen	Mg.L <sup>-1</sup>	22.2
	Phosphor	Mg.L <sup>-1</sup>	5.05
	Potassium	Mg.L <sup>-1</sup>	166
Organic matter		%	1.7
Calcium Carbonate			27
Soil Particles	Sand		44.66
	Loam		40.6
	Clay		14.45
Soil texture		Loam	

**Studied Characteristics****Average fruit size (cm<sup>3</sup>)**

A particular size of water was added to a cylinder using the displaced water method. Following that, 25 fruits were put inside the cylinder, and the size was determined by comparing the water levels in the two situations.

**Fruit weight (g)**

At the harvest, 25 fruits were taken randomly from each fruit cluster, weighed with a sensitive scale, and the fruit weight obtained by dividing the selected fruit weight by number of fruits.

**Average kernel weight (g)**

Each fruit cluster had 25 randomly selected fruits, and the fruit seeds were extracted from them, then they were weighed, and the average seed weight was calculated.

**Amount of total yield (kg)**

The total yield of each palm tree is calculated by taking the weight at harvest (immediately after cutting the stems) using a field scale, then it was calculated for each treatment separately.

**Statistical analysis**

At a probability level of 0.05, the Duncan's multinomial test was used in the analysis of data [2.]

**Results and discussion****The size of the fruit**

The findings of Table 2 revealed that a significant impact between pollen cultivars. The pollen mixture (yellow ganami + red ganami) exceeded 12.01 cm<sup>3</sup>, while the fruit size of the yellow ganami pollen cultivar reached 10.64 cm<sup>3</sup>. Spraying of calcium at 2000 mg/L led to significantly superior in the fruit size, 11.47 cm<sup>3</sup>, over the control, which reached 11.06 cm<sup>3</sup>. The findings also revealed that the interaction between the pollen cultivar and spraying with calcium significantly affected the size of the fruit. The calcium spraying at 2000 mg/L with the pollen mixture (yellow ganami + red ganami) recorded 12.32 cm<sup>3</sup>, when the combined between the treatments. The calcium spraying at 1000 mg/L and without spraying with the yellow ganami pollen cultivar recorded the lowest fruit size, reaching 10.62 and 10.35 cm<sup>3</sup>, respectively.

**Fruit weight**

The findings of Table 3 revealed a significant impact between the pollen cultivars on fruit weight, as the pollen mixture (yellow ganami + red ganami) was superior by 14.72 g, while the fruit weight of the yellow ganami pollen cultivar was 9.50 g. The calcium spraying at 2000 mg/L was significantly outstanding in

terms of fruit weight, 10.55 g over the control of 13.37 g. The calcium spraying at 2000 mg/L with the pollen mixture (yellow ganami + red ganami) was significantly outstanding to the other treatments, amounted to 11.77 g, whereas the treatment without spraying with the yellow ganami pollen cultivar recorded a lower fruit weight of 9.11 g, when the combined between the treatments.

#### Kernel weight

The findings of Table 4 indicate a significant impact between the pollen cultivars on kernel weight, as the mixture of pollen grains (yellow ganami + red ganami) was superior by 1.10 g, while the weight of the kernel in the yellow pollen cultivar, amounted to 1.05 g. The calcium spraying at 2000 and 1000 mg/L were significantly outstanding to the control treatment, which amounted to 1.06 g, by a percentage of 1.09 g for both treatments. The interaction between the pollen cultivar and calcium spraying was significantly outstanding in terms of kernel weight, as the calcium spraying at 1000 and 2000 mg/L with the pollen mixture (yellow ganami + red ganami) significantly exceeded the other treatments and reached 1.12 g for both, while the treatment without calcium spraying with the yellow ganami pollen cultivar recorded a lower kernel weight of 1.02 g.

#### Total yield

The results presented in Table 5 confirmed that the type of pollen gave a significant impact on the amount of total yield, as the pollen mixture (yellow ganami + red ganami) exceeded the value of 141.34 kg compared to the red ganami cultivar, which amounted to 132.61 kg. The calcium spraying at 2000 mg/L was significantly outstanding in terms of total yield, 135.04 kg over the control, which recorded the lowest value, 129.38 kg. The interaction gave a significant impact on the

total yield. The spraying treatment at concentrations of 1000 and 2000 mg/ L with the pollen mixture (yellow ganami + red ganami) was significantly outstanding to the cultivar treatment without spraying, amounted to 143.74 and 143.06 kg. The treatment without spraying with the yellow ganami pollen cultivar recorded the lowest percentage of fruit ripening, reaching 120.00. kg.

The findings presented that pollen cultivar have a significant effect on most physical characteristics. The pollen mixture (red pollen + yellow pollen) was superior in giving the better findings for fruit size, fruit weight, and kernel weight. The reason for this superiority may be due to the success of the pollination process and fruit formation, as the vitality of pollen is more significant for the pollination process, which can directly affect the percentage of ripe fruits and the amount of total yield [13]. The decrease in the amount of yield may be due to the insufficient vitality, germination, and strength of pollen fertility [7]. The kernel weight increase may be attributed to the pollen grains in the pollen mixture (red ganami + yellow ganami) are of high fertility, which led to the success of the pollination process in the Barhi cultivar. The reason for the difference between pollen cultivars may also be attributed to the differences in compatibility levels between the Barhi cultivar and its pollinators, as the source of pollen greatly affects the amount of yield [10]. These findings are agree with the results of [5] in his experiment to evaluate the impact of different pollen cultivars on the physical characteristics of the Barhi date palm. It is consistent with the findings of [18] when using different pollen sources, and a significant difference was found between pollinators in the physical characteristics studied, such as (fruit size, kernel and fruit

weight, and total yield). The increase in kernel weight and fruit may be due to the action of calcium on increasing the activity of kernel defense enzymes; also, the increase in clusters weight and the total yield indicate that calcium in the appropriate concentration has a significant positive effect on protecting plasma

#### Conclusion

The pollination mixture of the cultivars, red ganami and yellow ganami, as well as calcium spraying at 2000 mg/L, excelled in enhancing

membranes and regulating osmotic and cytoplasmic pressure, which promotes cell differentiation, growth, and development [8]. The calcium also regulates water absorption and helps connect tissues, especially in the middle lamina [15].

the physical characteristics of the date palm, Barhi cultivar.

**Table 2. Impact of the inoculated cultivar and calcium spraying on the fruit size of date palm, Barhi cultivar**

Calcium (mg/ L)	Cultivar of pollen grains			
	Yellow ganami	Red ganami	Yellow and red ganami	Calcium means
0	10.35 f	10.90 de	11.75 b	11.06 C
1000	10.62 f	11.06 cd	11.98 b	11.22 B
2000	10.78 ef	11.31 c	12.32 a	11.47 A
<b>Cultivar means</b>	10.64 C	11.09 B	12.01 A	

**Table 3. Impact of the inoculated cultivar and calcium spraying on the fruit weight of date palm, Barhi cultivar.**

Calcium (mg/ L)	Cultivar of pollen grains			
	Yellow ganami	Red ganami	Yellow and red ganami	Calcium means
0	9.11 e	9.75 d	21.27 b	13.37 C
1000	9.66 d	9.95 d	11.12 b	10.24 B
2000	9.75 d	10.15 c	11.77 a	10.55 A
<b>Cultivar means</b>	9.50 C	9.85 B	14.72 A	

**Table 4. Impact of the inoculated cultivar and calcium spraying on the seed weight of date palm, Barhi cultivar**

Calcium (mg/ L)	Cultivar of pollen grains			
	Yellow ganami	Red ganami	Yellow and red ganami	Calcium means
0	1.02 e	1.08 cd	1.08 cd	1.06 B
1000	1.05 d	1.10 b	1.12 a	1.09 A
2000	1.08 c	1.08 c	1.12 a	1.09 A
<b>Cultivar means</b>	1.05 C	1.08 B	1.10 A	

**Table 5. Impact of the inoculated cultivar and calcium spraying on the total yield of date palm, Barhi cultivar**

Calcium (mg/ L)	Cultivar of pollen grains			
	Yellow ganami	Red ganami	Yellow and red ganami	Calcium means
0	120.00 g	130.93 d	137.22 b	129.38 C
1000	123.98 f	132.42 d	143.06 a	133.15 B
2000	126.85 e	134.53 c	143.74 a	135.04 A
<b>Cultivar means</b>	132.61 C	132.63 B	141.34 A	

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