

## Effect of Spraying GA<sub>3</sub> with Different Concentrations on Productivity and Some Fruit Physical Properties of Barhee Date Palm Fruits

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### Abstract

The experiment was carried out during the 2023 and 2024 seasons in a private orchard located at El-Mansoria district (Egypt - Alexandria Desert Road), El-Giza Governorate, Egypt, to investigate the effects of foliar application of GA<sub>3</sub> on productivity and fruit quality of 'Barhee' date palm. GA<sub>3</sub> at 5, 10, 15, 20 and 25 ppm was applied to the date palms and the control palms were sprayed with tap water only. Investigate were recorded on fruit properties (productivity and some fruit physical properties) like fruit retention (%), yield/palm (kg), fruit weight (kg), bunch weight (kg), seed (%) and flesh (%) as well as fruit length (cm), fruit shape index, fruit diameter (cm), firmness (g/cm<sup>2</sup>), moisture (%), marketable fruits and unmarketable fruits. Results indicated that GA<sub>3</sub> (10 ppm) spray favorably influenced productivity and fruit quality of 'Barhee' date palm over control. Similarly, the fruit set was increased. Although individual fruit weight was reduced slightly, fruit number and marketable yield was increased tremendously over control with no adverse effect on fruit quality characteristics. GA<sub>3</sub> spraying was much more effective in achieving the desirable results in both seasons.

**Keywords:** 'Barhee' date palm, GA<sub>3</sub>, Foliar spray, Productivity and Fruit quality.

### 1. Introduction

Date palm (*Phoenix dactylifera* L.) is regarded as the tree of life in the desert because it can withstand higher temperatures, droughts and salinities than many other fruit crops. It is a member of the Arecaceae family [1]. It is thought to have about 2,000 types worldwide, making it one of the oldest and most economically significant trees in the Middle East and North Africa. With an annual yield of 7.5 million tons of fruit, its economic utility is multifaceted and comprises staple foods, beverages, ornamentals, and building materials [2].

In Egypt, date palm is the most productive and significant crop in terms of commerce. There are over 14636968 date palm trees in Egypt, and they yield 1703378 tons/season [3]. One of the top ten countries in the world for date production is Egypt. Dates are now cultivated and produced as an export good. The history of nations is in for a bright future. In the nations that grow dates given the financial, nutritional and medicinal benefits of dates, palm farming has expanded, particularly in desert regions. International date palm cultivars of superior quality and high output are known as Barhee cv. In three stages, its fruits are consumed. According to Khlal, Egypt is the world's top producer of wet dates. The most economically significant date palm cultivars cultivated in Egypt are Zaghloul, Samany, Hayany and Sewy. Date growers currently face numerous challenges in producing high-quality date fruits for financial reasons and to compete in the global market [4,5].

One type of phytohormone that controls plant growth and development is bioactive gibberellin (GA<sub>3</sub>). GA<sub>3</sub> has a role in the reproductive development of plants by stimulating the growth of organs (by improving cell division and elongation) and triggering developmental events such as seed germination, maturation, and blooming induction [6]. The control mechanism of GA<sub>3</sub> and the use of exogenous plant hormones in horticulture crops' postharvest storage quality have been the subject of contemporary research. In the late 1950s, GA<sub>3</sub> was identified as a naturally occurring plant hormone that stimulated increased plant growth [7]. With kaurene as its backbone, GA<sub>3</sub> belong to a class of phytohormones. A broad class of diterpenoid carboxylic acids, categorized by structure, is present in GAs.

Gibberellins (GA<sub>3</sub>) are essential plant hormones that control fruit growth and development. According to recent research, GA<sub>3</sub> is crucial in postponing the ripening and senescence of horticultural crops, improving their internal and exterior quality, and increasing their resistance to disease and stress. In recent years, we examined the function of GA<sub>3</sub> in fruit postharvest physiology. Fruit senescence retardation is intimately associated with GA<sub>3</sub>. GA<sub>3</sub> has the potential to dramatically increase flesh hardness, decrease respiration intensity, prevent the generation of endogenous ethylene, and successfully prevent fruit ripening and softening, all of which could improve the quality of fruit stored in storage. By enhancing fruit form, controlling color, postponing the decrease of soluble solids, encouraging sugar accumulation, and postponing vitamin loss, it can also enhance the

intrinsic and extrinsic quality of fruit preservation. Additionally, GA<sub>3</sub> contributes to resilience to biotic and abiotic stress after harvest. The cold damage index is successfully lowered, superoxide anion (O<sub>2</sub>) production and accumulation are decreased, fruit antioxidant capacity is increased, and cell membrane integrity is preserved during low-temperature storage thanks to the GA<sub>3</sub> treatment. Additionally, GA<sub>3</sub> may be able to successfully manage a few postharvest fruit illnesses. In summary, GA<sub>3</sub> has significant application potential in postharvest fruits and is crucial for the physiological regulation of postharvest fruits [8].

By governing cell growth and enlargement, lengthening fruit stalks, regulating fruit shape, modifying pigment content, and modifying fruit color, gibberellins may affect how a fruit looks [8]. Gas has been demonstrated to have an impact on the fruit shape index, which is a quality indicator for commercial fruits and is calculated as the ratio of the fruit's longitudinal to transverse diameters [9]. The "Hayward" kiwi fruit's pedicel received GA<sub>3</sub>, which lengthened the terminal pedicel and changed the fruit form index [10]. Apple fruit form and stalk length could be greatly enhanced by GA<sub>3</sub> [11]. Similar experimental findings from a different study on "Chandler" strawberries revealed that GA<sub>3</sub> and cytokinin, which are chemicals with cell division activity, might encourage cell elongation and so achieve an elongation of fruit stalk length to improve

the fruit shape index [12]. It has been discovered that treating tomato fruit with GA<sub>3</sub> can increase cell enlargement and expansion, increasing the form index [13]. When GA<sub>3</sub> was sprayed on self-pollinated apple plants, the weight of the fruits increased, the percentage of asymmetric fruits decreased, and the exterior fruits' quality and shape returned to those of cross-pollinated fruits [11].

While inquiring about quality characters, a current investigation was carried out to inquire about the best concentration of spraying GA<sub>3</sub>.

The aim of the present study was conducted to investigate the effect of different concentrations of spraying GA<sub>3</sub> on improving productivity and some fruit quality parameters of Barhee date palm.

## 2. Materials and Methods

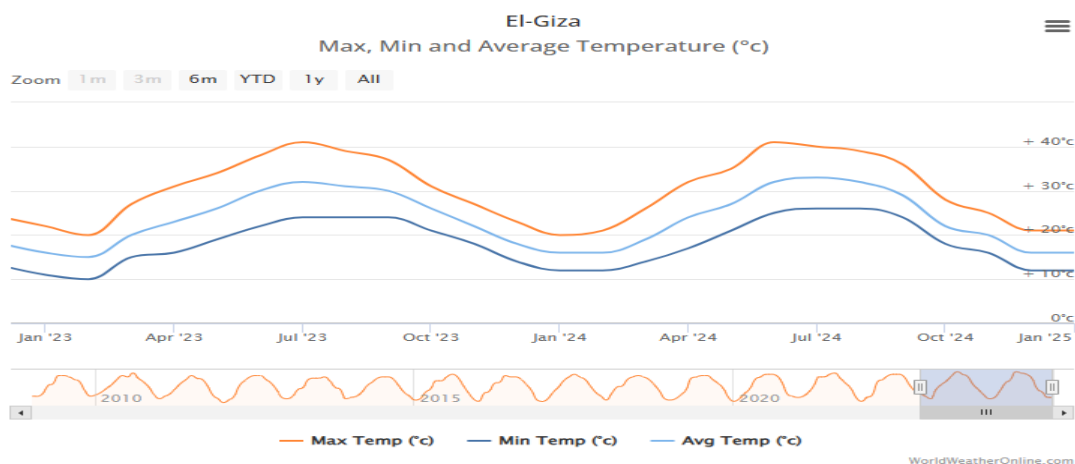
This study was carried out during the 2023 and 2024 seasons in a private orchard located at El-Mansoria district (Egypt - Alexandria Desert Road), Giza Governorate, Egypt. 'Barhee' date palms of healthy, nearly homogenous in growth as well as fruiting ability were selected. According to the Ministry of Agriculture's recommendations, all were exposed to the same horticultural practices (fertilization, weed control, insect management, and irrigation) that were used in the region.

**Table (1): The maximum and minimum temperature and rain data for the whole year as an average taken from the last 12+ years of historical data El-Giza Governorate**

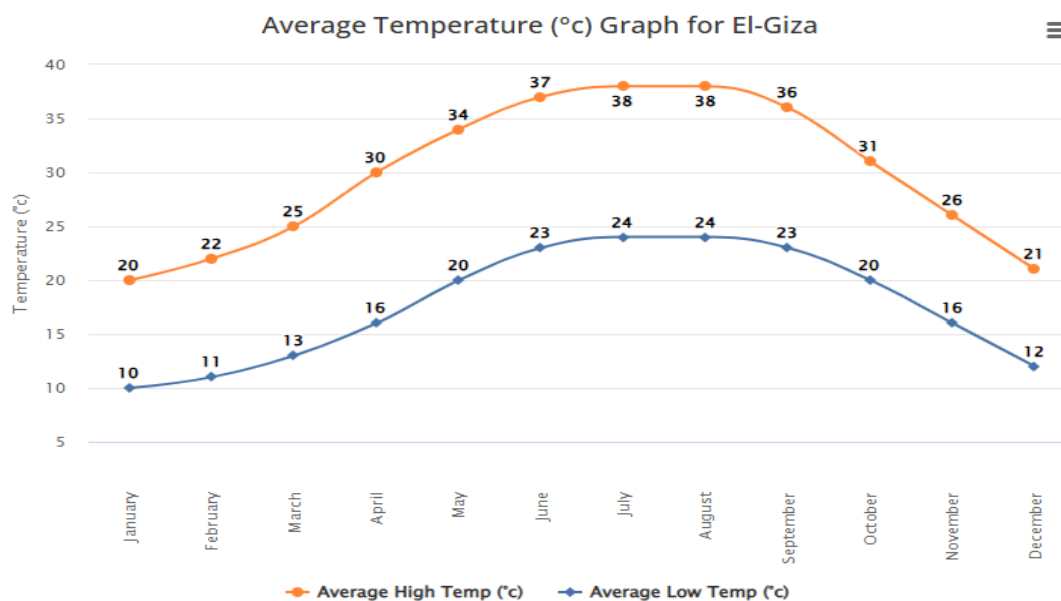
Month	Day	Night	Rain Days
January	20°C	10°C	1
February	22°C	11°C	1
March*	25°C	13°C	0
April*	30°C	16°C	0
May*	34°C	20°C	0
June*	37°C	23°C	0
July*	38°C	24°C	0
August	38°C	24°C	0
September	36°C	23°C	0
October	31°C	20°C	0
November	26°C	16°C	0
December	21°C	12°C	0

\*Average weather in El-Giza Governorate during treatment periods (World WeatherOnline.com.)

## Yearly Max, Min and Average Temperature



## Average Temperature



**Fig. (1):** The maximum and minimum temperature and rain data for the whole year as an average taken from the last 12+ years of historical data for El-Giza Governorate.

The present experiment included five treatments for each GA<sub>3</sub> concentration in addition to the control treatment (water spray) Were applied as spray 5 times/season at the one-month interval in the 1<sup>st</sup> week of March, April, May, June and July as follows:

T<sub>1</sub>-Control (water spray)

T<sub>2</sub> -Foliar spray with GA<sub>3</sub> 5 ppm.

T<sub>3</sub>- Foliar spray with GA<sub>3</sub> 10 ppm.

T<sub>4</sub>- Foliar spray with GA<sub>3</sub> 15 ppm.

T<sub>5</sub>- Foliar spray with GA<sub>3</sub> 20 ppm.

T<sub>6</sub>- Foliar spray with GA<sub>3</sub> 25 ppm.

### Experiments layout:

The complete randomized block design with three replications was employed for arranging the six investigated spraying treatments experimental seasons, whereas a single tree represented each replicate. Consequently, 18 healthy, fruitful Barhee date palm plants were carefully selected as being healthy, and disease-free.

**Application time:**

Taking into consideration that spray treatments were applied covering the Barhee dates of each palm, 10 liters were found to be sufficient in this concern. Besides, periodically applied 5 times/season at the one-month interval in the 1<sup>st</sup> week of March, April, May, June and July.

**Data and Measurements:**

The response to spray treatments investigated was evaluated by determining changes exhibited in the following properties:

**1. Yield:****A. Fruit retention percentage (%):**

Fruit retention %

$$= \frac{\text{Number of presented (remained) fruits at a given date}}{\text{Number of set fruitlets}} \times 100$$

**B. Bunch weight (kg), average fruit weight (g) and yield (kg/palm).**

**2. Fruit physical characteristics:**

Twenty-five fruits were randomly sampled from each palm for this purpose, were used to determine the fruit flesh (%), then the fruit seed (%) and fruit flesh/seed ratio. Meanwhile, length & diameter in cm, fruit shape index (length: diameter) and Moisture (%) were calculated. Firmness (g/cm<sup>2</sup>) were measured using a pressure tester with a 7/18 plunger [14]. Moreover, marketable fruits (%) and unmarketable fruits (%) were the fruit physical characteristics investigated in this regard.

**Statistical analysis:**

The obtained data were subjected to an analysis of variance according to [15]. Duncan's

multiple range test [16] at the 5% level was used to compare the mean values.

**3. RESULTS AND DISCUSSION****3.1. Effect of spraying GA<sub>3</sub> with different concentrations on productivity of Barhee date palm****3.1.1. Fruit retention percentage (%) and Bunch weight (kg)**

**Table (2)** displays obviously that the percentage of remaining fruits at a given measuring date varied significantly from one investigated nutritive compounds treatment to other/s. Also, Bunch weight (kg) followed to a great extent the same trend with Fruit retention (%). Anyhow, the third treatment (GA<sub>3</sub> at 10 ppm) was statistically superior. Meanwhile, the second treatment (GA<sub>3</sub> 5 ppm) ranked statistically second, discerningly followed by 4<sup>th</sup> treatment (GA<sub>3</sub> at 15 ppm), while the control showed the least increase in retained fruit % and Bunch weight (kg).

The enhanced effects of GA<sub>3</sub> spraying on date cell expansion during active growth stages may be responsible for the reported results. As a result, upon harvest, substantial fruit and a bunch might be gathered [17].

These results are consistent with the preliminary findings and were published by [18] on Barhee date palm, [19] on date palm var. Zaghloul and [20] on Zaghloul and Samani varieties date palm, where they deduced that spraying different concentrations of GA<sub>3</sub> on resulted in significant increases in bunch weight and consequently yield weight/palm. On the other hand, [21] on Khadrawy date palm found that yield weight (kg/palm) no constant effects with spraying GA<sub>3</sub> (100 ppm).

**Table (2):** Effect of spraying GA<sub>3</sub> with different concentrations on fruit retention percentage (%) and bunch weight (kg) of Barhee date palms during 2023 and 2024 seasons.

Parameters Treatments	Fruit retention (%)		Bunch weight (kg)	
	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024
<b>T1- Control</b>	30.33D	33.44D	15.38D	15.46D
<b>T2- GA<sub>3</sub> 5 ppm</b>	35.53B	37.12B	16.42B	17.15B
<b>T3- GA<sub>3</sub> 10 ppm</b>	37.50A	39.80A	18.13A	18.46A
<b>T4- GA<sub>3</sub> 15 ppm</b>	32.05C	35.45C	16.12C	16.17C
<b>T5- GA<sub>3</sub> 20 ppm</b>	27.25E	32.27E	14.29E	15.10E
<b>T6- GA<sub>3</sub> 25 ppm</b>	26.85F	30.17F	14.16F	14.41F

Means followed by the same letter/s within each column didn't significantly differ at 5 % level.

**3.1.2. Yield/palm (kg) and average fruit weight (g):**

**Table (3)** shows that all spray investigated concentrations of GA<sub>3</sub> increased significantly in both fruiting parameters (yield) i.e., fruit weight and yield per palm of Barhee date palm cv. as compared to the analogous ones of control (water spray) during two

experimental seasons. However, the effectiveness of such spray treatments was not equal. It could safely be said that yield/palm (kg) in the response to the differential treatments investigated was not only significant but also followed to a great extent the same trend previously discussed with fruit retention (%) and

bunch weight (kg). Herein, T3- GA<sub>3</sub> at 10 ppm its highest concentration was statistically superior, descendingly followed by T2 spray treatment i.e., T2- GA<sub>3</sub> at 5 ppm which ranked 2<sup>nd</sup> from the statistical point of view, respectively. On the contrary, average fruit weight (g) of sprayed Barhee palm with T4- GA<sub>3</sub> at 15 ppm was the most effective. While T2- GA<sub>3</sub> at 5 ppm was the least effective despite they were still effective and exceeded significantly control (water spray) for two fruiting measurements during 2023 & 2024 experimental seasons.

The highest fruit weight (g) and yield /palm (kg) were obtained from bunches that were sprayed with GA<sub>3</sub>. GA<sub>3</sub>'s positive effects on promoting cell elongation, improving water absorption, and

accelerating protein production [22] could explain the present results.

These studies' obtained results concur with those discovered by [23] on Khalas date palm and [20,24] on dates palm ( Zaghoul and Samani varieties), where they pointed out that weight and volume of fruits were improved by spraying GA<sub>3</sub>. Contrary to that [25] showed that applying GA<sub>3</sub> on bunches of dates palm (Zahdi and Sayer cvs) (at 12-14 weeks after pollination) had no marked improvement in weight or volume of fruits. Moreover, [26] reported that bagging bunches of date palm Zaghoul cv (45 days after pollination) improved the fruits' physical characteristics, with the exception of pulp percentage per fruit

**Table (3):** Effect of spraying GA<sub>3</sub> with different concentrations on yield/palm (kg) and average fruit weight (g) of Barhee date palms during 2023 and 2024 seasons.

Parameters Treatments	Yield /palm (kg)		Average fruit weight (g)	
	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024
T1- Control	215.37D	216.49D	15.95E	16.16F
T2- GA <sub>3</sub> 5 ppm	229.83B	240.10B	16.24D	16.44E
T3- GA <sub>3</sub> 10 ppm	253.82A	258.39A	19.17A	19.14B
T4- GA <sub>3</sub> 15 ppm	225.73C	226.38C	19.22A	19.34A
T5- GA <sub>3</sub> 20 ppm	200.06E	211.45E	16.44C	16.56D
T6- GA <sub>3</sub> 25 ppm	198.19F	201.69F	18.10B	18.14C

Means followed by the same letter/s within each column didn't significantly differ at 5 % level.

### 3.2. Effect of spraying GA<sub>3</sub> with different concentrations on Fruit physical characteristics of Barhee date palm

#### 3.2.1. Flesh (%), seed (%) and pulp /seed ratio:

In this regard, flesh (%), seed (%) and pulp /seed ratio were evaluated of Barhee date palm in response to different applied GA<sub>3</sub> concentrations treatments. Data obtained during 2023 and 2024 experimental seasons are presented in **Table (4)**. It was so worthy to be noticed that two conflicting trends were detected. Anyhow, **Table (4)** displays obviously that the five investigated treatments with GA<sub>3</sub> increased significantly the fruit flesh (%) and pulp /seed ratio followed to a great extent the same trend regarding their response to evaluated spray treatments over control (water sprayed). However, the fourth treatment i.e., Barhee date palm subjected to spray with GA<sub>3</sub> at 15 ppm statistically the superior. Whereas the greatest fruit flesh (%) and pulp /seed ratio in Barhee date palm is 91.16 (%) and 10.32, respectively. Were exhibited during both experimental seasons,

respectively. However, 3<sup>rd</sup> treatment (GA<sub>3</sub> at 10 ppm) ranked statistically second. On the other hand, the fruit seed (%) the trend of response to various spray solution treatments took the other way around to that previously detected with above discussed two physical characteristics. Herein, the fruit of control (water sprayed) showed statistically the highest value i.e., its seed trended to be less control during both experimental seasons. Since the rate of decrease in fruit seed (%) over control to each treatment was separately concerned.

These findings from this study are consistent with those published by [23] on date palms Gur and Khalas cvs. [19] on date palm Zaghoul cv, where they reported that flesh weight or flesh/seed ratio perfruit increased by spraying GA<sub>3</sub>, decreased seed weight %/ fruit. In contrast to that [25] on date palms Zahdi and Sayer cvs, [27,28] on date palms Khaniczy or Barhi cvs, and [21] on date palm Khadrawy cv showed that seed weight % per fruit and flesh weight of the studied date palm cvs no constant effects by using GA<sub>3</sub> application.



**Table (4):** Effect of spraying GA<sub>3</sub> with different concentrations on flesh, seed and pulp/seed ratio percentages of Barhee date palm fruits during 2023 and 2024 seasons.

Parameters Treatments	Flesh (%)		Seed (%)		Pulp /seed ratio	
	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024
T1- Control	87.44E	87.54F	12.56A	12.46A	6.96F	7.03F
T2- GA <sub>3</sub> 5 ppm	88.21D	88.34E	11.79B	11.66B	7.48E	7.57E
T3- GA <sub>3</sub> 10 ppm	90.36B	90.43B	9.64E	9.57E	9.38B	9.45B
T4- GA <sub>3</sub> 15 ppm	91.12A	91.16A	8.88F	8.84F	10.27A	10.32A
T5- GA <sub>3</sub> 20 ppm	88.35D	88.50D	11.65C	11.50C	7.58D	7.70D
T6- GA <sub>3</sub> 25 ppm	89.16C	89.24C	10.84D	10.76D	8.22C	8.30C

Means followed by the same letter/s within each column didn't significantly differ at 5 % level.

### 3.2.2. Fruit length, diameter and fruit shape index:

In this regard, three fruit physical characteristics dealing with fruit length, fruit diameter and fruit shape index in response to spray with GA<sub>3</sub> were investigated. Data obtained during 2023 & 2024 seasons are concentrations of GA<sub>3</sub> presented in **Table (5)**. It is quite evident that these investigated fruit physical characteristics indeed average fruit length and fruit diameter not typically follow the same trend previously detected. Since, spraying fruits with GA<sub>3</sub> substance i.e., T6- GA<sub>3</sub> at 25 ppm and T5- GA<sub>3</sub> at 20 ppm surpassed significantly all investigated spray treatments as the increase over control (water spray) was concerned during both experimental seasons. On the other hand, it is obvious that five investigated treatments with GA<sub>3</sub> increased fruit length, fruit

diameter, and fruit shape index of the fruits over control (water sprayed).

The findings of this investigation are consistent with those published by [23] on date palms Gur and Khalas cvs, [19] working with GA<sub>3</sub> on date palm Zaghoul cv, [25] on date palms Zahdi and Sayer cvs, and [20,24] on date palms Zaghoul and Samani cvs where they demonstrated that treatments increased both length and diameter of fruit with GA<sub>3</sub>. As well as [29] and [26] deduced that bagging date palms Zaghoul and Samani cvs bunches improved fruit physical characteristics except pulp % per fruit.

While, [18] on date palms Barhee cv, [27,28] on date palms Khaniczy and Barhi cvs, and [21] on date palms Khadrawy cv demonstrated that GA<sub>3</sub> spraying did not consistently affect fruit attributes or enhance fruit quality.

**Table (5):** Effect of spraying GA<sub>3</sub> with different concentrations on fruit length, diameter and fruit shape index of Barhee date palm fruits during 2023 and 2024 seasons.

Parameters Treatments	Fruit length (cm)		Fruit diameter (cm)		Fruit shape index	
	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024
T1- Control	3.13F	3.15F	2.67D	2.73E	1.17C	1.16C
T2- GA <sub>3</sub> 5 ppm	3.20E	3.25E	2.93C	2.97D	1.09E	1.09D
T3- GA <sub>3</sub> 10 ppm	3.34D	3.37D	2.99B	3.04C	1.12D	1.11D
T4- GA <sub>3</sub> 15 ppm	3.48C	3.53C	3.00B	3.10B	1.16C	1.14C
T5- GA <sub>3</sub> 20 ppm	3.75B	3.76B	3.03A	3.18A	1.24B	1.18B
T6- GA <sub>3</sub> 25 ppm	3.83A	3.89A	2.98B	3.02C	1.28A	1.29A

Means followed by the same letter/s within each column didn't significantly differ at 5 % level.

### 3.2.3. Fruit firmness and moisture (%):

In this regard, fruit firmness and moisture (%) were evaluated during both the 2023 and 2024 experimental seasons are presented in **Table (6)**. It was so worthy to be noticed that two different trends were detected. Anyhow, **Table (6)** displays obviously that five investigated treatments with GA<sub>3</sub> increased significantly the fruit firmness followed to a great extent the same trend regarding their response to evaluated spray treatments over control (water sprayed). However, the 3<sup>rd</sup> treatment i.e., Barhee date palm subjected to GA<sub>3</sub> at 10 ppm statistically superior.

Were exhibited during both experimental seasons, respectively. However, 2<sup>nd</sup> treatment (GA<sub>3</sub> at 5 ppm) ranked statistically second. On the other hand, fruit moisture (%) the trend of response to various spray solution treatments took a different way around to that previously detected with the above discussed. Herein, the 3<sup>rd</sup> treatment (GA<sub>3</sub> at 10 ppm) showed statistically the lowest value i.e., its seed trended to be most in control during both experimental seasons. Since the rate of decrease in fruit seed weight over control to each treatment was separately concerned.

**Table (6):** Effect of spraying GA<sub>3</sub> with different concentrations on fruit firmness and moisture (%) of Barhee date palm fruits during 2023 and 2024 seasons.

Parameters Treatments	Firmness (g/cm <sup>2</sup> )		Moisture (%)	
	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024
T1- Control	5.95D	6.03D	61.00C	61.15C
T2- GA <sub>3</sub> 5 ppm	6.21B	6.40B	58.34E	59.27D
T3- GA <sub>3</sub> 10 ppm	6.41A	6.44A	57.45F	57.37F
T4- GA <sub>3</sub> 15 ppm	6.05C	6.30C	59.05D	59.16E
T5- GA <sub>3</sub> 20 ppm	5.94D	5.94E	61.27B	61.68B
T6- GA <sub>3</sub> 25 ppm	5.83E	5.81F	62.69A	63.26A

Means followed by the same letter/s within each column didn't significantly differ at 5 % level.

### 3.2.4. Marketable and unmarketable fruits (%):

In this regard, marketable and unmarketable fruits (%) were the evaluated of Barhee date palm in response to different applied treatments GA<sub>3</sub> concentrations treatments. Data obtained during both the 2023 and 2024 experimental seasons are presented in **Tables (7)**. It was so worthy to be noticed that two conflicting trends were detected. Marketable fruits (%) took the other way around to unmarketable fruits (%). Anyhow, **Table (7)** displays obviously that the five investigated treatments with GA<sub>3</sub> increased

significantly marketable fruits followed to a great extent by the same trend regarding their response to evaluated spray treatments over control (water sprayed). However, the 3<sup>rd</sup> treatment i.e., Barhee date palm subjected to GA<sub>3</sub> at 10 ppm statistically superior. On the other hand, the unmarketable fruits (%) herein, the fruit of the 3<sup>rd</sup> treatment (GA<sub>3</sub> at 10 ppm) showed statistically the least value, while the 6<sup>th</sup> treatment showed the highest value during both experimental seasons.

**Table (7):** Effect of spraying GA<sub>3</sub> with different concentrations on marketable and unmarketable fruits (%) of Barhee date palm fruits during 2023 and 2024 seasons.

Parameters Treatments	Marketable fruits (%)		Unmarketable fruits (%)	
	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024	1 <sup>st</sup> season; 2023	2 <sup>nd</sup> season; 2024
T1- Control	82.74C	82.53C	17.26D	17.47D
T2- GA <sub>3</sub> 5 ppm	87.86B	87.95B	12.14E	12.05E
T3- GA <sub>3</sub> 10 ppm	89.05A	88.98A	10.95F	11.02F
T4- GA <sub>3</sub> 15 ppm	81.66D	81.54D	18.34C	18.46C
T5- GA <sub>3</sub> 20 ppm	80.73E	80.51E	19.27B	19.49B
T6- GA <sub>3</sub> 25 ppm	78.92F	78.86F	21.08A	21.14A

Means followed by the same letter/s within each column didn't significantly differ at 5 % level.

## 5. Conclusion

It can be concluded from the above results that concentrations of GA<sub>3</sub> sprays, had a positive effect on fruit retention (%), bunch weight (kg), yield /polm (kg), fruit weight (g), fruit flesh (%), fruit seed (%), pulp /seed ratio, fruit length (cm), fruit diameter (cm), fruit shape index, firmness (g/cm<sup>2</sup>), Moisture (%), Marketable fruits (%), and Unmarketable fruits (%)

which reflected on enhanced productivity and fruit physical characteristics compared with control. Therefore, it could be recommended that spraying Barhee date palms grown under similar environmental conditions and horticulture practices be used in the present experiment with different concentrations to improve productivity and fruit physical properties.



**Photo (1):** Effect of spraying GA<sub>3</sub> with different concentrations on fruit shape (length (cm) & fruit diameter (cm)) of Barhee date palm fruits during 2023 and 2024 seasons.

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