

## Effect of spraying GA<sub>3</sub> and some plant extracts on yield and fruit quality of Barhee date palms

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### Abstract

The effects of GA<sub>3</sub> and some plant extract on fruiting of Barhee date palm grown in Agricultural Research Station farm that located at Kom Omboo, Aswan Governorate, Egypt were investigated during 2020, 2021 and 2022 seasons. All treatments were sprayed three times after two, eight and ten weeks of pollination. The experiment was set up in a complete randomized block design with five replications of one bunch each.

The obtained results could be summarized as follow:

- Fruit retention percentage were significantly decreased due to spray GA<sub>3</sub> at 25 or 50, whereas hibiscus or turmeric extract had insignificant effected compared to unsprayed one (control).
- Spraying the bunch with GA<sub>3</sub> at 25 or 50 ppm gave the highest fruit weight, flesh percentage and dimation of fruits followed sprayed with hibiscus compared to unsprayed ones.
- All spraying significantly improved the chemical fruit properties in terms of the total soluble solids and sugar contents and significantly decreased the total acidity and total soluble tannins percentages compared to unsprayed ones. No significantly differences were seen due to use 25 or 50 ppm GA as well as 1000 or 2000 of extracts of hibiscus or turmeric extracts.

So, it concluded that spray GA<sub>3</sub> at 25 or 1000 ppm of hibiscus or turmeric three times after 2, 8 and 10 weeks of pollination to obtain the high yield with good quality of Barhee dates. GA<sub>3</sub> reduce the fruit retention and consequently increase the fruit weight and size induce increased the yield. Also, hibiscus or turmeric induced an increase in fruit weight and size then get high yield of Barhee dates. Thus, spraying the bunches of Barhee date palm with 25 ppm GA<sub>3</sub> or 1000 ppm hibiscus or turmeric had get the heaviest yield with improvement the physical and tested chemical fruit properties.

**Keywords:** Date palm, Gebbberelic acid, Hibiscus, Turmeric, yield, fruit quality.

### Introduction

Date palm (*Phoenix dactylifera* L.) is an ancient fruit crop found in many places throughout the world because of the plant adaption to a wide range of environmental and soil conditions. It is one of the ancient domestic fruit trees in the Middle East and north Africa countries and their fruits play an important role in the nutrition pattern of

many people as well as a strategic crop for food and biochemical industries. The fruits are rich source in carbohydrates, especially sugars and antioxidants [1]. Egypt is one of the major dates producing countries in the world, the total number of females and annual production of date palms reached 14379648 palms with 1644417 ton, respectively [2], which around 18% of the global production.

In Egypt, many cultivars are grown in different regions according to the diversity of their climatic necenity, particularly average temperature and relative humidity that affect fruit growth and development. Barhee cultivar is one of the most economically important semi-dry dates and is used demand in local and foreign markets. Date fruits constitute a substantial part of diet for Egyptian people. Plant growth regulators as foliar applications are the most powerful tools for manipulating tree growth, flowering, yield and fruit quality particularly fruit size, as well as, controlling the fruit maturation. In addition, by hastening or delaying fruit maturation the growers can utilize peak demands, avoid unfavorable environmental conditions and extend the market period as well as act as messenger and are needed in small quantities [3]. The growth regulators are known by their ability to increase the cell size and enhance fruit growth of dates [4].

Application of Samany, Barhee, Zaghloul, Khalas, Sakkoty and Seewy date palms with GA<sub>3</sub> at 50, 100 or 200 ppm significantly increased fruit weight and fruit dimensions and fruit moisture contents compared to control. On the other hand, such treatments delayed color change and ripening [3],[5],[6],[7],[8],[9],[10].

GA<sub>3</sub> spray delayed fruit ripening, as reflected by lower rutab percentage and higher acidity, phenols and tannins concentration. Fruit length significantly increased by GA<sub>3</sub> spray at 100 and 150 ppm compared to the control. GA<sub>3</sub> spray increased total soluble solid (TSS) and acidity concentration compared to the control. Generally, bunch weight was higher and fruit quality was better [11],[12].

Treatment with spraying with some growth regulators like Gibberellic acid (GA<sub>3</sub>), naphthalene acetic acid (NAA), benzil adenine (BA) and SA (salicylic acid) on Barhee Cv. increased the yield, as well as chemical and physical properties as compared with control [3],[13],[14].

The use of natural compounds as plant extracts in alternative to the industrial chemical fertilizers is highly recommended to conserve the environment and avoid the residual effect of synthetic fertilizers [15]. Using natural plant extracts are effective in improving yield and quality of fruit orchards as safety agents for human and environment and cost effective [16].

Roselle (*Hibiscus sabdariffa* L.) belongs to the family Malvaceae. The edible portio is not flowers but calyces. Roselle main ingredients are vitamins C, A, D, B1 and b12, antioxidants, anthocyanins, Fe, Mg and Omega 3 beta carotene [17]. Furthermore, using extracts of roselle improve the nutritional status, yield and fruit quality. The beneficial of roselle extracts on building plant pigments and organic foods surely reflected on advancing maturity and improving fruit quality [18],[19].

Turmeric is the dried rhizome of the plant *Curcuma longa* L. It is contains 0.5% volatile oil. This oil contains about 60% turmeric, 25% zingiberene and small quantities d-a-phellandrene, d-sabiene, cineole and forneol.

Curcumin which gives turmeric a yellow color, along with nutritional ingredients such as potassium. The extracts are characterized by their higher content of organosulfur compounds, volatile components, fats, proteins, nutrients, tannins, vitamins, and antioxidants [20].

Using four sprays of either oils of garlic, onion or moringa at 5% as well as extracts of turmeric, Red chillis or green tea at 5% mid of April, May, June and July is responsible to increase the yield and improve the fruit quality of Sakkoti date palms [21]. Spraying either yeast, amino acids, extract of turmeric or cinnamon had efficiently on Sewi date palms to enhance productivity and fruit quality. They can be safely applied in replacement of synthetic fertilizers, as natural products harmless for human health and the environment [22].

So, the purpose of this study was to shed more light on the benefits of GA<sub>3</sub> and some plant extracts hibiscus and turmeric spraying on fruiting of Barhee date palm under Aswan climatic conditions, Egypt.

### Materials and Methods

The present study was carried out during three successive seasons of 2020, 2021 and 2022 on five uniform Barhee date palms in research farm of Agricultural research station that located at Kom Omboo, Aswan Governorate, Egypt where the soil has a silty clay texture. Palms were selected randomly and at similar age 20 years-old, uniform in vigour, healthy, good physical conditions, free from insects, damages and diseases. They subjected to the same management and cultural practices, for example, artificial pollination, pruning, irrigation, fertilization and manuring. Bunches were thinned to 12 per palm by removing excess earliest, latest and smallest ones. The artificial pollination was uniformly performed in respect of source, date and method.

This investigation included seven treatments with different concentration of gibberellic acid (GA<sub>3</sub>) and hibiscus and turmeric extracts. Then, the treatments are as follows:

- 1- Spraying the bunches with distilled water (control) (T1).
- 2- Spraying the bunches with GA<sub>3</sub>, 25 ppm (T2).
- 3- Spraying the bunches with GA<sub>3</sub>, 50 ppm (T3).
- 4- Spraying the bunches with 1000 ppm hibiscus extract (T4).
- 5- Spraying the bunches with 2000 ppm hibiscus extract (T5).
- 6- Spraying the bunches with 1000 ppm turmeric extract (T6).
- 7- Spraying the bunches with 2000 ppm turmeric extract (T7).

Solutions of above concentration of GA<sub>3</sub> as well as hibiscus and turmeric extract were solubilized with distilled water as well as distilled acetone and then sprayed on the bunches. GA<sub>3</sub> and plant extracts were sprayed three times at two, eight and ten weeks of pollination, Triton B as a wetting agent was added to all spraying solutions before application to facilitate the solubility of these used materials. Manual sprayers were used spraying was done till runoff.

These treatments were applied on the same palm. Bunches were sprayed using a small hand sprayer until runoff. Bunches were separated from each side with plastic sheets to avoid any overlap between them.

This experiment was arranged in a complete randomized block design (RCBD) with five replications, one bunch each.

The following measurements were determined during the three investigated seasons.

### Yield components

The fruit retained percentage were calculated at harvest. Five inner and outer strands per spathe after at harvest time. The percentage of fruit retention were calculated using the following equation:

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

Bunches were harvested at the first week of August when fruits reached Khalal stage and their weighing were recorded. Twenty five fruits from each bunch were picked at random to determine the physical fruit characteristics, i.e. fruit weight, dimensions, percentage of flesh weight. The chemical constituents i.e. TSS% using the hand refractometer, total and reducing sugars, as well as, total acidity % (as a citric acid/100 g pulp) and total soluble tannins % were determined according to [23].

Statistical analysis was done according to [24] using L.S.D. at 5% to compare among different treatment means.

## Results

### 1- Yield components:

The retention percentage and bunch weight are considered as index for the yield. Data presented in Table 1 show the effect of GA<sub>3</sub> and extract of hibiscus and turmeric spraying on retention percentage and bunch weight of Barhee date palm during 2020, 2021 and 2022 seasons. It is obvious from the data that the results took similar trend during the three studied seasons.

As a general overlook at the results, it could be observed that the fruit retention percentage were significantly decreased due to spray of GA<sub>3</sub> compared to unsprayed one (control). The recorded fruit retention % was 33.99, 30.15, 30.65, 35.55, 35.83, 35.72 & 35.94% as an av. of three studied seasons for control (T1), GA<sub>3</sub> (25 ppm, T2), hibiscus extract at 1000 ppm (T4), or 2000 ppm (T5), turmeric extracts at 1000 ppm (T6) and 2000 ppm (T7), respectively. The least fruit retention (30.15 & 30.65%) was recorded on the bunches that sprayed with 25 ppm GA<sub>3</sub> (T2) or 50 ppm GA<sub>3</sub> (T3) during three seasons, respectively. Then the decrement percentage of fruit retention attained (11.29 & 9.83% as an av. of three studied seasons for T2 and T3 compared T1, respectively).

On the other hand, all treatments significantly increased the bunch weight and yield/palm compared to untreated one (control). The value of bunch weight were 12.45, 15.26, 15.17, 14.38, 14.72, 14.22 & 14.38 kg and the yield/palm was 149.4, 183.1, 187.4, 172.6, 176.5, 170.7 & 172.5 kg/palm as an av. the three studied seasons, respectively. Then the corresponding increment percentage of bunch weight attained 22.57, 21.84, 15.50, 18.23, 14.22 & 15.50% for T2 to T7 compared to T1, respectively.

In general, these findings indicated that it should be sprayed GA<sub>3</sub> thrice at 25 ppm as well as hibiscus or turmeric thrice at 1000 ppm to obtain the high yield of Barhee date palms. Where the GA<sub>3</sub> reduce the fruit set and then give a chance for the better growth of the fruits well and high yield. On other hand, the hibiscus or turmeric spray increase the fruit weight and size, hence get high yield of Barhee date palm.

**Table (1): Effect of GA<sub>3</sub> and some plant extracts spraying on yield component of Barhee date palm during 2020, 2021 and 2022 seasons.**

Charac Treat.	Fruit retention (%)				Bunch weight (k)				Yield/palm (kg)			
	2020	2021	2022	Mean	2020	2021	2022	Mean	2020	2021	2022	Mean
<b>T1</b>	31.28	36.49	34.20	<b>33.99</b>	10.15	13.95	13.25	<b>12.45</b>	121.8	167.4	159.0	<b>149.4</b>
<b>T2</b>	28.56	33.70	31.18	<b>30.15</b>	12.38	17.12	16.28	<b>15.26</b>	148.6	205.4	195.4	<b>183.1</b>
<b>T3</b>	28.11	33.15	30.69	<b>30.65</b>	12.65	17.55	16.65	<b>15.17</b>	151.8	210.6	199.8	<b>187.4</b>
<b>T4</b>	32.73	38.34	35.58	<b>35.55</b>	11.72	16.13	15.30	<b>14.38</b>	140.6	193.6	183.6	<b>172.6</b>
<b>T5</b>	33.10	38.26	36.12	<b>35.83</b>	11.98	16.49	15.68	<b>14.72</b>	143.4	197.9	188.2	<b>176.5</b>
<b>T6</b>	32.95	38.38	35.82	<b>35.72</b>	11.58	15.89	15.19	<b>14.22</b>	139.0	190.7	182.3	<b>170.7</b>
<b>T7</b>	33.18	38.46	36.18	<b>35.94</b>	11.70	16.10	15.33	<b>14.38</b>	140.4	193.2	184.0	<b>172.5</b>
<b>LSD</b>	<b>1.95</b>	<b>2.13</b>	<b>2.18</b>		<b>0.63</b>	<b>0.86</b>	<b>0.75</b>		<b>7.35</b>	<b>9.55</b>	<b>9.38</b>	

T1- Control (water spray). T2- 25 ppm GA<sub>3</sub>. T3- 50 ppm GA<sub>3</sub>. T4- 1000 ppm hibiscus  
 T5- 2000 ppm hibiscus.  
 T6- 1000 ppm turmeric. T7- 2000 ppm turmeric.

## 2- Physical characteristics:

Data presented in Tables (2 and 3) show the effect of GA<sub>3</sub> and extract of hibiscus or turmeric spraying on some physical properties i.e. fruit weight and flesh percentage as well as dimensions of Barhee dates during 2020, 2021 and 2022 seasons. Spraying Barhee date bunches with either GA<sub>3</sub>, hibiscus or turmeric significantly increased the fruit weight, flesh percentage and dimensions of Barhee date in compared unsprayed one.

Spraying 25 or 50 ppm GA<sub>3</sub> gave the highest fruit weight, flesh percentage and dimension of fruits compared to unsprayed one. The recorded fruit weight were 12.37, 16.37, 16.85, 13.77, 13.89, 13.51 & 13.62 g as an av. of three studied seasons, flesh percentage was 87.88, 91.19, 91.41, 90.48, 90.66, 90.22 & 90.32% as an av. of three studied seasons, respectively. Hence, the heaviest fruit weight (16.37 & 16.85 g) was recorded on bunch that sprayed with either GA<sub>3</sub> at 25 or 50 ppm against (12.37 g) in unsprayed ones as an av. the three studied seasons, respectively. The corresponding increment percentage due to these treatments over unsprayed ones attained 32.34, 36.22, 11.32, 12.29, 9.22 & 10.11% as av. of three studied season due to T2, T3, T4, T5, T6 and T7 compared to T1, respectively.

On the other hand, the maximum values of fruit flesh 91.19 & 91.41% was recorded on bunch that sprayed with GA<sub>3</sub> at 25 or 50 ppm against 87.88% in unsprayed ones respectively. Hence, the corresponding increment percentage of flesh % attained 3.77 & 4.02% as av. of three studied seasons due to GA<sub>3</sub> spraying at 25 or 50 ppm compared to unsprayed ones (control), respectively.

**Table (2): Effect of GA<sub>3</sub> and some plant extracts spraying on fruit weight and flesh of Barhee date palm during 2020, 2021 and 2022 seasons.**

Charac. Treat.	Fruit weight (g)				Flesh %			
	2020	2021	2022	Mean	2020	2021	2022	Mean
<b>T1</b>	11.35	13.67	12.10	<b>12.37</b>	97.65	88.18	87.81	<b>87.88</b>
<b>T2</b>	14.93	17.95	16.22	<b>16.37</b>	90.92	91.55	91.10	<b>91.19</b>
<b>T3</b>	15.42	18.18	16.94	<b>16.85</b>	91.14	91.78	91.31	<b>91.41</b>
<b>T4</b>	12.80	14.96	13.55	<b>13.77</b>	90.18	90.86	90.41	<b>90.48</b>
<b>T5</b>	12.93	15.10	13.65	<b>13.89</b>	91.38	91.03	90.58	<b>90.66</b>
<b>T6</b>	12.50	14.78	13.26	<b>13.51</b>	89.94	90.58	90.13	<b>90.22</b>
<b>T7</b>	12.63	14.92	13.32	<b>13.62</b>	90.15	90.64	90.18	<b>90.32</b>
<b>LSD</b>	<b>0.65</b>	<b>0.81</b>	<b>0.73</b>		<b>2.18</b>	<b>2.33</b>	<b>2.20</b>	

**Table (3): Effect of GA<sub>3</sub> and some plant extracts spraying on fruit length and fruit diameter of Barhee date palm during 2020, 2021 and 2022 seasons.**

Charac. Treat.	Fruit length (cm)				Fruit diameter (cm)			
	2020	2021	2022	Mean	2020	2021	2022	Mean
<b>T1</b>	3.15	3.25	3.20	<b>3.20</b>	2.18	2.23	2.22	<b>2.21</b>
<b>T2</b>	3.48	3.75	3.70	<b>3.64</b>	2.38	2.56	2.53	<b>2.49</b>
<b>T3</b>	3.52	3.81	3.76	<b>3.70</b>	2.41	2.58	2.54	<b>2.51</b>
<b>T4</b>	3.33	3.42	3.37	<b>3.37</b>	2.31	2.35	2.32	<b>2.33</b>
<b>T5</b>	3.36	3.44	3.40	<b>3.40</b>	2.34	2.35	2.33	<b>2.34</b>
<b>T6</b>	3.31	3.43	3.37	<b>3.37</b>	2.31	2.36	2.32	<b>2.33</b>
<b>T7</b>	3.32	3.43	3.56	<b>3.44</b>	2.32	2.35	2.32	<b>2.33</b>
<b>LSD</b>	<b>0.15</b>	<b>0.17</b>	<b>0.13</b>		<b>0.10</b>	<b>0.11</b>	<b>0.08</b>	

Also, the highest fruit length 3.64 & 3.70 cm was recorded on the bunches that sprayed with either GA<sub>3</sub> 25 or 50 ppm, respectively, against 3.20 cm in unsprayed ones. The corresponding increment percentage of fruit length due to these treatments over control was 13.75 & 15.63% as an av. of three studied seasons, respectively.

Moreover, the highest values of fruit diameter (2.49 & 2.51 cm) was recorded on bunch that sprayed with GA<sub>3</sub> 25 or 50 ppm against 2.21 cm in unsprayed ones. The corresponding increment percentage of fruit diameter due to these treatments unsprayed ones attained 12.67 & 13.57% as an av. of three studied seasons, respectively.

Generally, the above results disclosed that no significant difference between 25 or 50 GA<sub>3</sub> as well as 1000 or 2000 ppm on physical properties of dates. Hence, it could be concluded that spraying GA<sub>3</sub> at 25 or 1000 ppm hibiscus or turmeric to get highly improved all physical properties. Such treatment are very important target than total yield due to the improve in physical fruit traits induce an increase in packable yield.

### 3- Chemical characteristics:

Data presented in Tables (4, 5 & 6) show the effect of GA<sub>3</sub> as well as hibiscus or turmeric extracts spraying on some chemical properties i.e. total soluble solids, sugar contents, as well as total acidity and total soluble tannins percentage of Barhee date fruits during 2020, 2021 and 2022 seasons.

Spraying Barhee date bunches with either GA<sub>3</sub>, hibiscus or turmeric extracts significantly improved the dates chemical constituents in terms of increasing the total soluble solids and sugar contents and decreasing the total acidity and total soluble tannins percentages compared to unsprayed ones.

It could be simply to see from data that total soluble solids were equivalent to sugar content and reversed current with total acidity and tannin content.

In general, view, spraying GA<sub>3</sub>, hibiscus or turmeric thrice gave the highest total soluble solids and sugar contents of fruits during the three studied seasons. The recorded TSS % were 36.87, 37.15, 37.24, 38.93, 38.83, 38.49 & 38.64% as an av. of three studied seasons, total sugars % were 31.27, 31.61, 31.68, 33.16, 33.29, 33.06 & 32.94% as an av. of three studied seasons, reducing sugars % were 23.54, 23.96, 24.14, 24.98, 25.01, 24.85 & 24.75% as an av. the three studied seasons, respectively.

The highest TSS values were 38.93 & 38.83% as an av. of three studied season due to spray with hibiscus at 1000 ppm (T4) or 2000 ppm (T5), respectively. On other hand, the least ones was (36.87%) were recorded on unsprayed bunches. Hence, the corresponding increment percentage attained (5.59 & 5.32%), respectively. Also, the highest total sugars values were 33.36 & 33.29% as an av. of three studied season due to spraying with T4 or T5, respectively. On the other hand, the least ones was (31.27%) were recorded on untreated bunches. Hence, the corresponding increment percentage attained 6.68 & 6.46%, respectively.

On other hand, The recorded titratable acidity % were 0.134, 0.129, 0.128, 0.122, 0.121, 0.122 & 0.121% as an av. of three studied seasons and total soluble tannins % (0.230, 0.227, 0.220, 0.209, 0.209, 0.207 & 0.207% as an av. of three studied seasons), respectively.

Also, the least values of titratable acidity percentage (0.121 & 0.121% as an av. the three studied seasons) were recorded on fruits of bunches the received sprays 2000 ppm twice hibiscus or turmeric extracts compared the highest ones (0.143%) on fruit of bunches that untreated ones. Also, the least values of total soluble tannins percentage (0.207 & 0.207% as an av. of three studied seasons) were recorded on fruits of bunches that treated with T6 and T7 compared the highest ones (0.230%) on fruit of bunches that untreated ones control. Hence the decrement percentage of tannins due to T5 and T6 sprays under control attained (10.60 & 10.00% as an av. of three studied seasons), respectively.

Moreover, there are no significant differences between GA<sub>3</sub> sprayed and unsprayed ones. Also, no significant differences were recorded due spraying, any plant extract or any concentration of them. Thus, it is economical view to spray plant extracts at a lower concentration, in order to produce dates with highest quality.

Hence, it could be concluded that spraying 1000 hibiscus or 1000 ppm turmeric extracts to improve the tested chemical fruit properties.

It is suggested to twice spray GA<sub>3</sub> at 25 or 1000 ppm hibiscus or turmeric to obtain the high yield with good quality of Barhee dates.

**Table (4): Effect of GA<sub>3</sub> and some plant extracts spraying on flesh %, TSS and total sugars of Barhee date palm during 2020, 2021 and 2022 seasons.**

Charac. Treat.	TSS (%)				Total sugars %			
	2020	2021	2022	Mean	2020	2021	2022	Mean
<b>T1</b>	36.75	36.38	37.49	<b>36.87</b>	31.24	30.67	31.40	<b>31.27</b>
<b>T2</b>	37.00	36.63	37.80	<b>37.15</b>	31.61	31.10	32.31	<b>31.67</b>
<b>T3</b>	37.05	36.75	37.93	<b>37.24</b>	31.68	31.15	32.37	<b>31.72</b>
<b>T4</b>	38.71	38.45	39.64	<b>38.93</b>	33.39	32.70	33.98	<b>33.36</b>
<b>T5</b>	38.68	38.31	39.51	<b>38.83</b>	33.28	32.73	33.85	<b>33.29</b>
<b>T6</b>	38.35	37.97	39.15	<b>38.49</b>	32.99	32.45	33.73	<b>33.06</b>
<b>T7</b>	38.42	48.16	39.34	<b>38.64</b>	32.86	32.33	33.64	<b>32.94</b>
<b>LSD</b>	<b>1.05</b>	<b>1.28</b>	<b>1.31</b>		<b>1.31</b>	<b>1.20</b>	<b>1.38</b>	

**Table (5): Effect of GA<sub>3</sub> and some plant extracts spraying on reducing and non-reducing sugars of Barhee date palm during 2020, 2021 and 2022 seasons.**

Charac. Treat.	Reducing sugars (%)				Non-reducing sugars (%)			
	2020	2021	2022	Mean	2020	2021	2022	Mean
<b>T1</b>	23.67	23.18	23.76	<b>23.54</b>	7.57	7.49	8.14	<b>7.73</b>
<b>T2</b>	24.10	23.57	24.20	<b>23.96</b>	7.51	7.53	8.11	<b>7.71</b>
<b>T3</b>	21.22	23.78	24.41	<b>24.14</b>	7.40	7.39	7.96	<b>7.59</b>
<b>T4</b>	25.16	24.59	25.20	<b>24.98</b>	8.03	7.91	8.58	<b>8.17</b>
<b>T5</b>	25.15	24.63	25.26	<b>25.01</b>	8.13	8.10	8.59	<b>8.27</b>
<b>T6</b>	24.98	24.47	25.10	<b>24.85</b>	8.01	7.98	8.63	<b>8.21</b>
<b>T7</b>	24.89	24.38	24.97	<b>24.75</b>	7.97	7.95	8.67	<b>8.20</b>
<b>LSD</b>	<b>0.98</b>	<b>0.88</b>	<b>1.05</b>		<b>0.19</b>	<b>0.21</b>	<b>0.28</b>	

**Table (6): Effect of GA<sub>3</sub> and some plant extracts spraying on acidity and tannins of Barhee date palm during 2020, 2021 and 2022 seasons.**

Charac. Treat.	Titratable acidity %				Tannins (%)			
	2020	2021	2022	Mean	2020	2021	2022	Mean
<b>T1</b>	0.136	0.132	0.133	<b>0.134</b>	0.233	0.228	0.230	<b>0.230</b>
<b>T2</b>	0.132	0.128	0.128	<b>0.129</b>	0.224	0.216	0.214	<b>0.227</b>
<b>T3</b>	0.130	0.127	0.127	<b>0.128</b>	0.224	0.218	0.218	<b>0.220</b>
<b>T4</b>	0.124	0.121	0.122	<b>0.122</b>	0.213	0.208	0.206	<b>0.209</b>
<b>T5</b>	0.122	0.119	0.121	<b>0.121</b>	0.214	0.208	0.206	<b>0.209</b>
<b>T6</b>	0.123	0.120	0.122	<b>0.122</b>	0.211	0.205	0.206	<b>0.207</b>
<b>T7</b>	0.122	0.120	0.122	<b>0.121</b>	0.211	0.206	0.206	<b>0.207</b>
<b>LSD</b>	<b>0.005</b>	<b>0.005</b>	<b>0.006</b>		<b>0.007</b>	<b>0.008</b>	<b>0.006</b>	

### Discussion

Plant growth regulators play an important and major role in regulating fruit growth and development. Some of these substances were used in controlling ripening date (delayed ripening) as well as improving the fruit quality, which act for increasing the income and the revenues of farmers [11]. Sitofex (CPPU) is a new plant growth regulator

which has strong cytokinin activity by inducing fruit growth at low rates. Application of Sitofex at 1 to 20 ppm causes great effects on fruit size. The effectiveness was associated with methods of applications, the type of desired response, the developmental stage of the plant at time of application and other variables [25],[26].

The improvement of the fruit quality in response to use GA<sub>3</sub> was reported by [3], [6],[7],[8],[9],[10],[11],[13],[14],[27]. They concluded from their studies on different palm cultivars that spraying bunches with GA<sub>3</sub> was increased the fruit weight and fruit dimensions as well as the chemical properties of dates.

In the present study natural products such as hibiscus and turmeric extract were utilized to enhance fruit characteristics and yield of date palms. They are substances that promote plant growth, increase nutrient availability, and enhance quality attributes.

Plant extracts as turmeric and hibiscus were recently shown as an effective improver for plant growth and maturity. Turmeric is natural material with high content of cytokinin that stimulates cell division and expansions as well as the formation of protein, nucleic acid, and chlorophyll synthesise [28].

Similarly, hibiscus is a rich source of many important components such as proteins, carbohydrates, vitamins, and minerals [17] hence, considered as a stimulator for plant growth and development. The above mentioned findings are in accordance with those obtained [18], [21], [22], [29], [30], [31].

### Conclusion

On the light of the previous results, it could be concluded that spray Barhee dates, thrice with 25 ppm GA<sub>3</sub>, 1000 ppm hibiscus or 1000 ppm turmeric extracts after 2, 8 and 10 weeks of pollination to obtain the high yield with good quality. GA<sub>3</sub> reduce the fruit retention and thus give a chance for the growth of the fruits well and then increase the fruit weight and size induce increased the yield. On other hand, hibiscus or turmeric extracts induce an increasing in fruit weight and size and get high yield of Barhee dates. Thus, spraying the bunches of Barhee date palm with either GA<sub>3</sub> hibiscus or turmeric had get the highest yield with improvement the physical and tested chemical fruit properties.

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