The effect of adding chemical fertilizers and spraying with the growth regulator brassinolide and the interaction between them on the growth characteristics and chemical content of date palm trees cultivated in gypsum soils.

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Abstract:

The experiment was conducted in the Fallujah Palm Plant - Department of Horticulture - Ministry of Agriculture on palm trees of the Khostawi variety at the age of 10 years, from (15/2/2020) until (21/10/2020). The experiment included two factors, the first is the use of three fertilizer combinations in addition to the control treatment (F₀, F₁, F₂, and F₃). The second factor is the use of the brassinolide growth regulator with three concentrations (0, 0.040, and 0.060) mg.L⁻¹, symbolized as Br₀, Br₁, and Br₂, respectively. At a probability level of 0.05, the results of the study are summarized as follows:

Fertilization with the fertilizer mixture F₃ (urea 900 g + 450 g DAP + potassium sulfate 600 g) resulted in a significant increase in the average number of leaves, the rate of increase in the length of the fronds, the rate of increase in the length of the pinnae, the content of the leaves of chlorophyll, the percentage of dry matter of the leaves and the content of the leaves from Carbohydrates, nitrogen, phosphorous, potassium and protein, which amounted to 2.41 leaves, 0.203 cm, 0.71 cm, 54.55 spad units, 35.00%, 11.76%, 1.01%, 0.265%, 1.109%, 6.424%, while the control treatment gave the lowest rate for the aforementioned traits.

The spraying with the growth regulator brassinolide, especially the concentration 0.060 mg / L⁻¹, resulted in a significant increase in the rate of the number of leaves, the rate of increase in the length of the fronds, the rate of increase in the length of the pinnae, the content of the leaves of chlorophyll, the percentage of the dry matter of the leaves and the content of the leaves of nitrogen, phosphorous, potassium and protein as they reached 2.58 sheets, 0.248 cm, 0.81 cm, 54.78 spad unit, 33.67%, 0.97%, 0.287%, 1.081%, and 6.047%, while the control treatment gave the lowest rate for the aforementioned traits. The studied characteristics, as the interaction treatment F₃Br₂ gave the highest rate of increase in the studied traits, while the interaction F₃Br₁ was superior by giving it the highest content of carbohydrates in the leaves.

Key words: date palm, brassinolide, Khostawi, chemical fertilizers, gypsum

Introduction:

The date palm, which belongs to the order palmae, and is one of the most important botanical ranks known to man, and to the Areaceae family, which includes about 220 genera and 2,600 species (Al-Bakr, 1972). Iraq is one of the oldest palm cultivation habitats in the world. (Abass and Khairullah 2019), with an area of 76,400 thousand hectares, and the number of palm trees in Iraq is 151,139,076 trees. As for the total production, it is 646163 tons, and the average production for one palm is 66.7 kg palm-(Central Bureau of Statistics 2018).
The date palm in Iraq was exposed to many factors that led to a decrease in its numbers as a result of the conditions that the country went through, including wars, neglect, high salinity and pest infestation until the number of date palms reached low numbers after 2003, and Iraq as a major producer of dates declined to the fifth rank in the world after it was in the lead for many years (Ibrahim and Zayed, 2019).

Fertilization plays an important role in improving tree growth, especially since providing the necessary food for growth leads to a good completion of the formation of fruits. It was noticed that most of the orchards in which date palm cultivation is spread in the southern and central regions of Iraq show signs of general weakness and pale color or may stiffen the edges, which is a manifestation of the lack of mineral elements, and one of the main reasons for the decline in the productivity of the palm is the neglect of palm farmers for many agricultural operations, especially Fertilization (Salman et al., 2017).

Soliman and Shaban, (2006), found that ground fertilization with nitrogen and potassium in the form of ammonium nitrate and potassium sulfate at the level (2 kg palm\(^{-1}\text{-year}^{-1}\)) increased the leaf content of nitrogen, potassium and calcium and increased the number and length of leaves.

Al-Hamdani et al., (2011) and Al-Ani et al., (2011) found that chemical fertilization had a significant effect on vegetative growth characteristics and leaf content of nutrients, as it exceeded the level of the third fertilizer (urea 600 gm + Dab 375 gm + potassium sulfate 450 gm) and gave the highest rate of vegetative growth characteristics and chemical content. In addition to the possibility of mixing nutrients with plant growth regulators, including the brassinolide growth regulator (Focus, 2003) which we are dealing with in this experiment.

As for growth regulators, they are chemical compounds that are added in low doses and absorbed by plant tissues and then transported to their sites of action as they bind to the receptor, and then a secondary transmission system is activated to stimulate or inhibit cell activity (Puglisi, 2002). Brassinolide (BL) is the most effective BRs, whose function is to encourage growth and resist various stresses facing plants, and it has external uses that are described as environmentally friendly (Esposito et al., 2011) where compounds that are synthetic analogues to their equivalents within plants have been widely used in recent years. For horticultural crops, it increases yield, improves its quality, early ripens, and resists stress.

Al-Hamdani et al., (2018) found that spraying with the nutrient solution Miller and the growth regulator brassinolide at a concentration of 0, 0.01, 0.02 mg, L\(^{-1}\) on local orange seedlings, where the results of the study showed that spraying with a concentration of 0.02 mg-1 gave the highest significant increase in the rate of leaf area and length. Branch, stem diameter, dry matter ratio, nitrogen content, carbohydrates, phosphorous, potassium and protein.

**The study aim:** To determine the most appropriate fertilizer combination and concentration of the brassinolide growth regulator and the overlap between them for date palm trees of the Khostawe variety cultivated in gypsum soils.

**Materials and methods:** The experiment was carried out at the Fallujah Palm Plant belonging to the Horticulture Department / Ministry of Agriculture located west of Baghdad during the season 2020-2021. 36 palm trees of the Khostawi variety were selected, with a lifespan of approximately 10 years and homogeneous as possible in the strength of growth. The trees were watered from the water of the Euphrates River, and planted in the quadruplicate method 6 * 6 m, and all basic service operations were carried out on these trees of grinding and removing thorns evenly and unifying the number of Rows for fronds as much as possible, leaving 8-10 fronds for each sore. The trees were manually inoculated with (Red Ghanami) pollen. The number of Spadix (6 Spadix) was unified for each palm, distributed in equilibrium in the four directions, to ensure the homogeneity of the experimental units. Soil samples were randomly sampled from the orchard before processing three depths of 0-30 cm, 30-60 cm and 90-60 cm. Soil was analyzed to find out its physical and chemical properties (Table (1))
Table (1) some physical and chemical characteristics of field soil:

| The analysis results | Unit of measure used | Analysis          |
|----------------------|----------------------|-------------------|
| 7.42                 |                      | Ph                |
| 3.05                 | ms.cm^{-1}           | Electrical conductivity |
| 0.62                 | %                    | Organic matter    |
| 2.04                 | %                    | Clay              |
| 75.6                 | %                    | The sand          |
| 22.0                 | %                    | Silt              |
|                      | Lomay Sand           | Soil tissue       |
| 27.5                 | meq .L^{-1}          | Ca^{2+}           |
| 47.5                 | meq .L^{-1}          | Mg^{2+}           |
| 5.34                 | meq .L^{-1}          | Na                |
| 0.5                  | meq .L^{-1}          | CO_3              |
| 1.5                  | meq .L^{-1}          | HCO_3             |
| 2.5                  | meq .L^{-1}          | Cl                |
| 24.76                | meq .L^{-1}          | SO_4              |
| 2.6                  | Meq/100gm Soil       | CEC               |
| 7.1                  | Mgm .L^{-1}          | P                 |
| 129                  | Mgm .L^{-1}          | K^{+}             |
| 77                   | Mgm .L^{-1}          | N                 |

The analyzes were carried out in the laboratory of the Soil Research Department of the Agricultural Research Department, Baghdad / Abu Ghraib.

Search parameters:

The first factor: fertilizer combinations: in three batches (in February, April and July) as follows:
1. control transaction and its symbol $F_0$.
2. First treatment: Mixed fertilizer: Urea 300 gm + 150 gm DAP + Potassium Sulfate 200 gm. The symbol for it is ($F_1$).
3. The second treatment: mixed fertilizer: urea 600 gm + DAP 300 gm + potassium sulfate 400 gm. The symbol for it is ($F_2$).
4. The third treatment: mixed fertilizer: Urea 900 gm + 450 gm DAP + potassium sulfate 600 gm. The symbol for it is ($F_3$).

Factor 2: Spraying treatment with brassinolide growth regulator: - Brassinolide 24-Epibrassinolide The BL, which is a fine powder, was used by Phyto Technology Laboratories. The trees were sprayed twice, the first spray on 15/3/2020, and the second spray 21 days after the first spray, as follows:

1- Spray with water only (control treatment), symbol $B_{r0}$
2- Spraying with brassinolide acid at a concentration of 0.040 mg L$^{-1}$, symbol $B_{r1}$
3- Spraying with brassinolide acid at a concentration of 0.060 mg L$^{-1}$, symbol for $B_{r2}$

Diffuser Tween 20 (0.1%) was added to the prepared solutions to reduce surface tension of water and increase the adhesion of the material to the leaves, thus increasing absorption.

The experiment was carried out as a factor experiment (3 × 4) Factorial Design with two factors designing randomized complete blocks design, where the first factor included the combinations of fertilizer in four levels and the second factor the growth regulator of brassinolide in three levels, and by three replicates for one treatment and the one tree represents a duplicate, the statistical analysis was conducted. For the results data using the statistical program (Genstat) to analyze the variance, and the Least Significant Difference test (LSD) was used to compare the averages of the coefficients at a probability level of 0.05 (Al-Mohammadi and Al-Mohammadi, 2012).

The studied characteristics:

The rate of increase in the number of Leaves. It was calculated according to the following equation:

The rate of increase in new leaves = (number of leaves at the end of the experiment _ number of leaves at the beginning of the experiment).

The rate of increase in Leaf length (cm).

By taking the length of the leaves with the measuring tape from the area they connect to the trunk to the end of the leaf, and extract the rate and calculate the rate of increase according to the following equation: the increase in the length of the frond = (the length of the frond at the end of the experiment _ the length of the fronds at the beginning of the experiment).

The rate of increase in the length of the pinnae (cm): Take the length of the pinnae with the measuring tape from the area of its connection with the blade to the end of the pinnae, extract the rate and calculate the rate of increase according to the following equation: the increase in the length of the pinnae = (the length of the pinnae at the end of the experiment _ the length of the pinnae at the beginning of the experiment).

Leaf Relative Chlorophyll Content Measurement (SPAD Unit): Determine the relative chlorophyll concentration in leaves while on trees using a digital hand scale SPAD meter. Felixloh and Bassuk (2000).

Average percentage of dry matter in the leaves: Samples were taken from the third row post-core pinnaes of the growing seedlings( ALAni (1998)), washed well, dried, and weighed with an electric sensor, then dried in an electric oven at a degree of 70 m. When the weight was fixed, the following equation was applied: % of dry matter = weight Dry / fresh weight * 100.

The chemical qualities of the leaves include:

Leaf carbohydrate content (%): I used Joslyn (1970) to estimate carbohydrates.

Nitrogen content in leaves (%): Nitrogen was determined by distillation according to the method given in Bhargava and Raghupathi (1999).

Phosphorus content in leaves (%): Phosphorus is estimated by a Spectro photometer at a wavelength of 700 nanometers according to the method presented in (Jones & Steyn, 1973).

Potassium content in leaves (%): Potassium is estimated by means of a flame photometer according to the method presented in (Jones & Steyn, 1973).

The ratio of carbohydrates to nitrogen: It was calculated by dividing the results of the carbohydrate analysis by the results of the nitrogen analysis for each sample.
Results and discussion:

The rate of increase in the number and length of the leaves: We note from the results of table (2 and 3) that there are significant differences in the rate of increase in the number and length of the leaves due to the addition of the fertilizer combination, as the treatment F3 gave the highest rate of increase in the number and length of the leaves, as it reached 2.41 sheets, 0.203 cm, respectively. Then, treatments F1 and F2 were given an increment ratio of 2.22 leaves, 2.11 tree leaves, 0.197 cm, and 0.193 cm, respectively. While the F0 treatment gave the lowest rate of increase of 1.93 tree leaves and 0.175 cm, respectively.

The results of the statistical analysis showed in the same table the presence of significant differences as a result of spraying with the brassinolide growth regulator, as the treatment Br2 gave the highest rate of increase in the number and length of leaves, which reached 2.58 sheets, 0.248 cm, respectively, followed by the treatment Br1 by giving it an increase rate of 2.22 sheets, 0.196 cm, respectively. Whereas, the control treatment Br0 gave the lowest rate of increase of 1.71 leaves, 0.132 cm, respectively, and the results of Table (2) indicated that there were significant differences in the rate of increase in the number and length of leaves due to the overlap of fertilizer combinations and the growth regulator of the brassinolide, as the treatment F3Br2 gave the highest rate of increase of 3.33 sheets, 0.284 cm, respectively, while the treatment F3Br0 gave the lowest rate of increase in the number of papers, as it reached 1.57 sheets, while the control treatment F0Br0 gave the lowest average length of papers was 0.081 cm.

Table (2) The effect of fertilizer combinations and spraying with the growth regulator brassinolide and the interaction between them on the rate of increase in the number of leaves of date palm variety Khestawi

| The rate of fertilizer combinations | Growth regulator Brassinolide | Chemical fertilizer combinations |
|------------------------------------|-------------------------------|---------------------------------|
| F0                                | Br2  | Br1  | Br0  | F0  |
| 1.93                              | 1.67 | 2.20 | 1.93 | F0  |
| 2.22                              | 2.67 | 2.33 | 1.67 | F1  |
| 2.11                              | 2.67 | 2.00 | 1.67 | F2  |
| 2.41                              | 3.33 | 2.33 | 1.57 | F3  |
| 2.58                              | 2.22 | 1.71 | The rate of brassinoloid growth regulator |

F*Br= 1.01 Br= 0.50 F= 0.58 LSD 0.05

Table (3) The effect of fertilizer combinations and spraying with the growth regulator brassinolide and the interaction between them on the rate of increase in leaf length (cm) for date palm, variety Khostawi

| The rate of fertilizer combination | Growth regulator Brassinolide | Chemical fertilizers combinations |
|-----------------------------------|-------------------------------|---------------------------------|
| F0                                | Br2  | Br1  | Br0  | F0  |
| 1.93                              | 1.67 | 2.20 | 1.93 | F0  |
| 2.22                              | 2.67 | 2.33 | 1.67 | F1  |
| 2.11                              | 2.67 | 2.00 | 1.67 | F2  |
| 2.41                              | 3.33 | 2.33 | 1.57 | F3  |
| 2.58                              | 2.22 | 1.71 | The rate of brassinoloid growth regulator |

F*Br= 1.01 Br= 0.50 F= 0.58 LSD 0.05
The rate of brassinolid growth regulator

Average increase in pinnae length (cm)

In light of the results shown in table (4), it becomes clear that there are significant differences in the rate of increase in the length of the pinnae due to the addition of the fertilizer combination, as the treatment F3 gave the highest rate of increase in the length of the pinnae of 0.71 cm, which did not differ significantly with treatment F1 and F2, reaching 0.70 cm and 0.67 cm respectively. The control treatment F0 gave the lowest average pinnae length increase of 0.53 cm.

The results showed that the pinnae length increased as a result of spraying with the brassinolide growth regulator, as the treatment Br2 outperformed it by giving it the highest rate of increase in the pinnae length, reaching 0.81 cm, followed by the treatment Br1, which gave an increase in the pinnae length of 0.67 cm, while the control treatment gave the lowest rate of increase in the pinnae length is 0.48. The results of table (4) also indicated that there were significant differences in the rate of increase in the pinnae length due to the overlap of fertilizer combinations and the growth regulator brassinolide, as the treatment F3Br2 gave the highest rate of increase in the pinnae length of 0.94 cm, while the control treatment F0Br0 gave the lowest rate of increase in the pinnae length as It reached 0.44 cm.

Table (4) The effect of compost and spray combinations with the growth regulator brassinolide and the interaction between them on the rate of increase in pinnae length (cm) for date palm of the Khostawi variety.

| The rate of fertilizer combinations | Growth regulator Brassinolid | Chemical fertilizers combinations |
|-----------------------------------|-------------------------------|----------------------------------|
|                                   | Br2  | Br1  | Br0  |                                 |
| 0.53                              | 0.53 | 0.62 | 0.44 | F0                             |
| 0.70                              | 0.87 | 0.77 | 0.47 | F1                             |
| 0.67                              | 0.89 | 0.61 | 0.51 | F2                             |
| 0.71                              | 0.94 | 0.70 | 0.51 | F3                             |
|                                   | 0.81 | 0.67 | 0.48 | The rate of brassinolid growth regulator |
| F*Br=0.21                         | Br=0.11 | F= 0.12 | LSD 0.05 |
Leaf content of chlorophyll (SPAD unit): The results listed in table (5) show that there are significant differences in the leaves relative content of chlorophyll due to the addition of the fertilizer mixture, as treatment F3 gave the highest chlorophyll content of 54.55 SPAD unit, while treatment F0 gave the lowest content of chlorophyll reached 46.51 SPAD unit, which did not differ significantly with the two treatments F1 and F2.

The results showed that the leaf chlorophyll content increased as a result of spraying with the brassinolide growth regulator, as the treatment Br2 gave the highest chlorophyll content of 54.78 SPAD unit, followed by the treatment Br1 by giving it a chlorophyll content of 50.51 SPAD unit, while the control treatment Br0 gave the lowest chlorophyll content. It reached 41.96 SPAD unit, and the results of table (5) indicated that there were significant differences in the leaf content of chlorophyll due to the overlap of fertilizer combinations and the growth regulator brassinolide, as treatment F3Br2 gave the highest chlorophyll content of 72.02 SPAD unit, while treatment F0Br0 gave the lowest content as it reached 39.83 SPAD unit.

Table (5) The effect of fertilizer combinations and spraying with the growth regulator brassinolide and the interaction between them on the leaf content of chlorophyll (spad unit) for date palm of the Khostawi variety.

| The rate of fertilizer combinations | Growth regulator Brassinolid | Chemical fertilizers combinations |
|-----------------------------------|-----------------------------|----------------------------------|
|                                   | Br2 | Br1 | Br0 | F0   | F1   | F2   | F3   |
| 46.51                             | 44.94 | 54.75 | 39.83 | F0   |      |      |      |
| 47.48                             | 51.61 | 47.43 | 43.39 | F1   |      |      |      |
| 47.80                             | 50.54 | 49.68 | 43.17 | F2   |      |      |      |
| 54.55                             | 72.02 | 50.18 | 41.45 | F3   |      |      |      |
| 54.78                             |      | 50.51 | 41.96 | The rate of brassinolide growth regulator |
| F*Br= 9.93                        | Br= 4.97 | F= 5.73 | LSD 8.05 |

Average percentage of dry matter in leaves: It is noticed from the data in table (6) that there were significant differences in the percentage of dry matter due to the addition of the fertilizer mixture, as treatment F3 gave the highest percentage of dry matter for the yield of 35.00%, then followed by treatment F2, which reached the percentage of material The dry wickness was 32.78%, which was not significantly different from the F1 treatment, which gave a dry wedge weight ratio of 31.11%, while the F0 control gave the lowest dry weight ratio of 26.89%.

The results of the same table showed that the average percentage of dry matter differed as a result of spraying with the brassinolide growth regulator, as the treatment Br2 outperformed by giving it the highest percentage, reaching 33.67%, while the control treatment Br0 gave the lowest dry weight ratio of 28.58%, as shown in the results of table (6). There were significant differences in the dry weight of the pinnas due to the overlap of fertilizer combinations and the growth regulator brassinolide, as the treatment F3Br2 gave the highest dry weight average for the pinnas, reaching 39.00%, while the control treatment F0Br0 gave the lowest rate of 21.67%.
Table (6) The effect of compost and spray combinations with the growth regulator brassinolide and the interaction between them on the average percentage of dry matter% in the leaves of date palm cultivar of Khestawi variety.

| The rate of fertilizer combinations | Growth regulator Brassinolid | Chemical fertilizers combinations |
|-----------------------------------|-------------------------------|----------------------------------|
|                                   | Br₂  | Br₁  | Br₀  | F₀   | F₁    | F₂    | F₃    | The rate of brassinolid growth regulator |
| 26.89                             | 30.00| 29.00| 21.67| F₀   | F₁    | F₂    | F₃    | Br=2.20/ F=2.54/ LSD 0.05 |
| 31.11                             | 32.00| 31.67| 29.67| F₁   | F₂    | F₃    |       |                                 |
| 32.78                             | 33.67| 33.00| 31.67| F₂   | F₃    |       |       |                                 |
| 35.00                             | 39.00| 34.67| 31.33| F₃   |       |       |       |                                 |
| 33.67                             | 32.08| 28.58|       |       |       |       |       |                                 |

Carbohydrate and nitrogen content in leaves (%):

We notice from the data in table (7 and 8) the presence of significant differences in the leaf’s carbohydrate and nitrogen content due to the addition of the fertilizer mixture, as treatment F₃ gave the highest carbohydrate and nitrogen content of 11.76% and 1.01% respectively, then followed by treatment F₂, which gave a carbohydrate and nitrogen content of 11.50% and 0.94% respectively, while the control treatment F₀ gave the lowest carbohydrate and nitrogen content of 0.72% and 0.90%, respectively.

The results of the same table showed significant differences as a result of spraying with the brassinolide growth regulator, as the largest share of increasing the carbohydrate and nitrogen content of the treatment Br₁ by giving it the highest content of 11.41% and 0.97% respectively, then followed by the treatment Br₂, which gave a carbohydrate and nitrogen content of 11.39%, 0.94%. Consequently, while the control treatment Br₀ gave the lowest carbohydrate and nitrogen content of 10.98% and 0.91% respectively, the results of Table (7,8) indicated that there were significant differences in the content of carbohydrate and nitrogen in the leaves due to the overlap of fertilizer combinations and the growth regulator brassinolide, as treatment F₁Br₁ outperformed by giving it the highest Carbohydrate content reached 11.87%, respectively, while treatment F₂Br₂ outperformed by giving it the highest nitrogen content of 1.10%, while the control treatment F₀Br₀ gave the lowest content at 9.98%, 0.87%, respectively.
Table (7) The effect of fertilizer combinations and spraying with the growth regulator brassinolide and the interaction between them on the leaves carbohydrate content (%) of date palm, cultivar Khestawi.

| The rat of fertilizer combinations | Growth regulator Brassinolide | Chemical fertilizers combinations |
|-----------------------------------|--------------------------------|---------------------------------|
|                                   | Br$_2$ | Br$_1$ | Br$_0$ | F$_0$ | F$_1$ | F$_2$ | F$_3$ | The rate of brassinolide growth regulator | LSD$_{0.05}$ |
| 10.72                             | 11.30  | 10.90  | 9.98   |       |       |       |       |                                   |             |
| 11.04                             | 11.00  | 11.03  | 11.10  |       |       |       |       |                                   |             |
| 11.50                             | 11.47  | 11.83  | 11.20  |       |       |       |       |                                   |             |
| 11.76                             | 11.80  | 11.87  | 11.60  |       |       |       |       |                                   |             |

F*Br=0.55

Table (8) The effect of fertilizer combinations and spraying with the growth regulator Brassinolide and the interaction between them on the nitrogen content in the leaves% of the date palm Khestawi.

| The rat of fertilizer combinations | Growth regulator Brassinolide | Chemical fertilizers combinations |
|-----------------------------------|--------------------------------|---------------------------------|
|                                   | Br$_2$ | Br$_1$ | Br$_0$ | F$_0$ | F$_1$ | F$_2$ | F$_3$ | The rate of brassinolide growth regulator | LSD$_{0.05}$ |
| 0.90                              | 0.93   | 0.92   | 0.87   |       |       |       |       |                                   |             |
| 0.91                              | 0.93   | 0.92   | 0.90   |       |       |       |       |                                   |             |
| 0.94                              | 0.92   | 0.95   | 0.94   |       |       |       |       |                                   |             |
| 1.01                              | 1.10   | 0.98   | 0.95   |       |       |       |       |                                   |             |
|                                   | 0.97   | 0.94   | 0.91   |       |       |       |       |                                   |             |

F*Br=0.05

The ratio of carbohydrates / nitrogen in the leaves: It is noticed from the data in table (9) that there are significant differences in the ratio of carbohydrates to nitrogen as a result of the addition of the fertilizer mixture, as treatment F$_2$ gave the highest ratio of carbohydrates to nitrogen amounting to 12.30, then followed by treatment F$_1$, which reached the ratio of carbohydrates to nitrogen In it, the control treatment F$_0$ gave the ratio of carbohydrates to nitrogen at 11.86, and the treatment F$_3$ gave the ratio of carbohydrates to nitrogen of 11.68, and the results showed that the ratio of carbohydrates to nitrogen did not differ significantly as a result of spraying with the growth regulator brassinolide.

The results of table (9) also indicated that there were significant differences in the ratio of the ratio of carbohydrates to nitrogen due to the overlap of fertilizer combinations and the growth regulator brassinolide, as
the treatment $F_3Br_2$ gave the highest carbohydrate to nitrogen ratio of 12.51, while the treatment $F_1Br_2$ gave the lowest carbohydrate to nitrogen ratio of 10.73.

Table (9) The effect of fertilizer combinations and spraying with the growth regulator brassinoide and the interaction between them on the ratio of carbohydrates / nitrogen in the leaves of the date palm cultivar Khestawi

| The rate of fertilizer combinations | Growth regulator brassinoide | Chemical fertilizers combinations |
|------------------------------------|------------------------------|----------------------------------|
|                                    | $Br_2$ | $Br_1$ | $Br_0$ | $F_0$ |
| 11.86                              | 12.20  | 11.89  | 11.50  | $F_0$ |
| 12.08                              | 11.87  | 11.98  | 12.37  | $F_1$ |
| 12.30                              | 12.51  | 12.47  | 11.91  | $F_2$ |
| 11.68                              | 10.73  | 12.11  | 12.21  | $F_3$ |
| 11.83                              | 12.21  | 12.00  |        | The rate of brassinoide growth regulator |
| $F*Br=0.87$                        | $Br=n.s$ | $F=0.50$ | LSD 0.05 |

Phosphorous and potassium content in leaves (%): It is evident from the results of table (10 and 11) that the significant effect of all fertilizer combinations began to be evident in light of the superiority of all treatments over the control treatment ($F_0$), especially treatment ($F_3$), which outperformed by giving it the highest content of phosphorus and potassium. In the papers, it reached 0.265% and 1.109% respectively, then followed by a significant difference of treatment $F_2$, which gave phosphorus and potassium content of 0.223% and 1.059% respectively, while the control treatment $F_0$ gave the lowest phosphorus and potassium content of 0.144% and 1.039%, respectively.

The results of the same table showed that there were significant differences as a result of spraying with the brassinoide growth regulator, as the treatment $Br_2$ gave the highest phosphorus and potassium content of 0.219% and 1.081% respectively, while the control treatment $Br_0$ gave the lowest content of 0.186% and 1.035%, respectively.

The results of table (10) also indicated that there were significant differences in the phosphorus content due to the overlap of fertilizer combinations and the brassinoide growth regulator, as treatment $F_3Br_2$ outperformed by giving it the highest phosphorus and potassium content of 0.287% and 1.157%, respectively, while the control treatment $F_0Br_0$ gave the lowest phosphorus and potassium content of 0.120% and 1.007%, respectively.

Table (10) The effect of fertilizer combinations and spraying with the growth regulator Brassinoide and the interaction between them on the phosphorous content in the leaves% of the date palm Khestawi.

| The rate of fertilizer combinations | Growth regulator Brassinoide | Chemical fertilizers combinations |
|------------------------------------|------------------------------|----------------------------------|
|                                    | $Br_2$ | $Br_1$ | $Br_0$ | $F_0$ |
| 0.144                              | 0.160  | 0.153  | 0.120  | $F_0$ |
| 0.180                              | 0.195  | 0.173  | 0.172  | $F_1$ |
The rate of brassinolid growth regulator

| F*Br=0.011 | Br=0.006 | F=0.006 | LSD 0.05 |
|------------|----------|---------|-----------|

Table (11) The effect of fertilizer combinations and spraying with the growth regulator Brassinolide and the interaction between them on the potassium content of the leaves% of the date palm Khestawi

| The rate of fertilizer combinations | Growth regulator Brassinolid | Chemical fertilizers combinations |
|------------------------------------|-----------------------------|----------------------------------|
|                                   | Br₂ | Br₁ | Br₀ | F₀ |
| 1.039                             | 1.060 | 1.050 | 1.007 | |
| 1.040                             | 1.050 | 1.040 | 1.030 | F₁ |
| 1.059                             | 1.057 | 1.063 | 1.057 | F₂ |
| 1.109                             | 1.157 | 1.123 | 1.057 | F₃ |
|                                   | 1.081 | 1.069 | 1.035 | The rate of brassinolid growth regulator |
| F*Br=0.026                        | Br=0.013 | F=0.015 | LSD 0.05 |

Conclusion:

The results of the study showed that the treatments of adding fertilizer blends to date palm trees were significantly characterized by vegetative characteristics. This may be attributed to the effect of the nutrients essential for growth such as nitrogen, phosphorous and potassium, which affect the vital activities in the plant (Osman et al., 2010) and thus increase their absorption by the plant, which is reflected. This leads to an increase in the vegetative growth characteristics, because the addition of chemical fertilizers to the soil may cause an increase in the major elements in the leaves and thus lead to an increase in the metabolic activities of the plant (Taiz and Zeiger, 2012). It is noticed that there is a significant increase in the percentage of dry matter. In pinnaes, the increase in the dry matter percentage may be due to the increase in the carbohydrate content of the leaves (table 6).

The reason for the increase in nitrogen in the leaves (Table 8) when treatment F3 may be due to the role of this fertilizer in preparing nitrogen directly to the soil, as adding it directly to the soil may lead to an increase in its concentration in the Rhizosphere, which helped the plant to absorb larger quantities of this The element increased its concentration in plant tissues, including the leaves (Mengel and Kirkby, 1982), and that nitrogen plays an important role in increasing vegetative growth, which leads to an increase in the products of photosynthesis and biological processes, thus increasing the activity of the roots and becoming more efficient in its absorption from the soil and then increasing its levels in Plant tissues These results are consistent with the findings of Al-Hamdani (2015). Perhaps the reason for the increase in the phosphorus component in the leaves, Table (10), is due to the direct addition of this element, which increases its concentration in the soil and thus increases its absorption by the plant, and the added nitrogen may have a role in lowering the soil pH, which caused an increase in phosphorus readiness for the plant, and these results are consistent with what was found. Al-Mubarak (2014) and Al-Hamdani (2015).
The reason for the increase in leaf potassium content when treatment F3 is due to the direct addition of this element, as well as the role of the potassium element in vegetative growth and the increase in the efficiency of photosynthesis, which results in its absorption to meet the plant’s need of it, especially as it is a carrier of carbohydrates and a stimulant for many enzymes. These results are consistent with what Finded by Hussein et al., (2011) and Al-Hamdani (2015). The improvement of vegetative growth characteristics in general is a result of BL treatment in stimulating the processes responsible for cell division and elongation.

These results are in agreement with those found by Frank-Duchenne et al., (1998). The increased growth can also be attributed to the interference of BL with other endogenous hormones, which includes a symbiotic response with auxins and a complementary effect by gibberellins (Mandava et al., 1981). The increase in the studied vegetative growth characteristics as a result of BL treatment may be due to the improvement of the mineral elements flow together with the growth regulators in the tissues of the treated plants.

The reason may be due to the fact that the BL increases the rate of photosynthesis, which is reflected in the morphological and physiological characteristics of the plant positively. It can also be explained on the basis that the treatment affected some physiological processes such as the absorption of water and nutrients that caused the increase in dry weight, area and leaf (Verma et al., 2009).

The fact that the BL treatment increases the total chlorophyll percentage may be due to the fact that this regulator prevents the breakdown of this pigment by stopping or reducing the activity of the chlorophyll enzyme, in addition to that it works to collect nutrients in the leaves and then increase the inside of them in the composition of the chlorophyll molecule (Abu Zaid, 2000).

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