Effect of zeolites and bio fertilizers on the growth of *Rosa hybrid* L

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Abstract

The experiment was conducted in the lathhouse of the Department of Plant Production Techniques / Al-Mussaib Technical College for the autumn season of 2021 and the spring season of 2022 to study the effect of zeolite and bio- inoculum on the growth of Rosa hybrid plant. It used plastic pots with a capacity of 27 cm filled with an agricultural medium consisting of (river soil + zeolite at different levels). The experiment included two factors, the first factor included four levels of zeolite without addition (the control treatment), adding (3 , 6 9)g.kg^{-1}.soil. As for the second factor, it included two levels of (Bio-healthWSG) water-soluble, organic vaccine without addition, adding 0.02 ml/liter. The results showed that the addition of zeolite had a significant effect on the studied traits . The addition treatment (9 mg. kg^{-1}) significantly excelled on the rest of the treatments and gave the highest values for the studied traits, plant height (82.9 cm), number of leaves (48.7 leaves. plant^{-1}), intensity of chlorophyll pigment (44.1 spad unit).fresh weight and The percentage of dry matter in the leaves (1.3 g, 0.5%), the content of the leaves of total carbohydrates (12.2 mg. 100 g dry weight-1). Also, the addition of the Bio-health had a clear effect on the traits of vegetative growth. The addition treatment (0.02 ml/L) was significantly excelled on the non-addition (0) and gave the highest values for the studied traits, plant height (74.5 cm).The number of leaves (44.8 leaves. plant-1), intensity of chlorophyll pigment (39.9 spad unit), wet weight and dry weight of the plant (1.2 g, 0.5%), total carbohydrate content of leaves (10.0 mg. 100 g. dry weight^{-1}) .The results also indicated that the interaction treatment (Zeolites 9 g/kg + bio-fertilizer 0.02 ml/L) was significantly excelled on all studied traits, plant height (91.6 cm).Number of leaves (50.0 leaves. plant^{-1}), intensity of chlorophyll pigment (47.4 spad unit), fresh weight and dry weight of the plant (1.4 g, 0.6%)The content of the leaves of total carbohydrates (12.7 g. dry weight^{-1}).

Keywords: zeolites, bio fertilizers, growth, *Rosa hybrid* L

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in the degree of soil interaction and thus increase the availability of phosphorus (Sharma et al. 2012,) (Etesami et al. 2020,).Seaweed extracts are one of the most popular organic biostimulants in recent years .It contains many important compounds such as vitamins, plant hormones and some organic compounds that contribute to the increase and growth of the plant (Ali et al., 2015). As well as containing betaine, which is a source of nitrogen in its low concentrations and a regulator of osmosis in its high concentrations, as well as improving the physical, chemical and biological properties of soil (Kageyama et al., 2017). As for zeolite, it is an aluminium silicate formed naturally or artificially that has been introduced in many agricultural applications, as it includes 50 types of important minerals (Ramesh et al., 2015). It is considered a soil fertiliser that increases production and helps in the slow release of adsorbed mineral elements and prevents their loss in the washing process, in

Introduction

The Rosa hybrid belongs to the Rosaceae family, and the genus Rosa contains 310 species and more than 30,000 commercial cultivars. Its flowers are among the most desirable species and these Rosa hybrid have been at the fore in the gardens of kings and greats for thousands of years until the present time due to their beauty, the multiplicity of colours, fragrant smell and suitability for picking, as well as their entry into the pharmaceutical and cosmetics industry. It is also used to treat mental disorders and skin diseases. (Yashaswini) et al., 2011. The modern trend includes gradual dispensing completely or partially from chemical fertilizers and relying on vital sources that supply plants with their nutritional needs. Bacillus bacteria dissolve organic phosphates and convert them from the complex form to the form absorbable by the plant, where they release acids such as formic and lactic (Formic-Lacetic) that lead to a decrease

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purchased at the age of one year, which was dated 10/15/2021, and kept in the lathhose of the department until it was planted in pots designated for the experiment. The seedlings of the two cultivars of shrub Rosa hybrid were transferred to pots of 9 kg of soil and 27 cm in diameter, filled with river soil medium + zeolite, according to the experimental parameters, + 3% decomposed sheep manure for all agricultural medium .A week after planting, the lengths of the seedlings were standardized by trimming them to 20 cm and keeping three branches for each plant. Samples were taken from different agricultural media, according to the experiment parameters, and the analyses were conducted in Al-Mussaib Technical Institute, Soil and Water Department laboratories, as shown in Table (1)

addition to its great role in increasing the efficiency of nitrogen use and thus mitigating the harmful effects of nitrogen fertilizers on the environment, and what encourages its use in agriculture is its cheap price and free from Harmful Substances (Rehakova),2004(

Materials and method

Experiment location:

The experiment was conducted in the canopy of the Department of Plant Production , Al-Mussaib Technical College, Middle Euphrates University / for the autumn season of 2021 and the spring season of 2022. To study the effect of zeolite and inoculation with microorganisms on the growth of Rosa hybrid . The seedlings of the two cultivars of V. Preciouy Moment Rosa hybrid , with a dark pink to violet color, and V. Rosa Pascal, with a snow-white color, were cultivated. It was

Table (1) Analysis of the cultivation medium for the experimental treatments(river soil + 3% decomposed sheep manure + zeolite)

units	values				Traits
	Z3	**Z2**	**Z1**	**Z0**	
	6.6	**6.7**	**6.9**	**7.20**	pH
g/kg soil	**3.45**	**3.30**	**3.29**	**3.25**	Organic matter
dsm-1	**1.09**	**1.45**	**1.52**	**1.86**	Electrical conductivity (Ec)
	6.70	**6.45**	**6.23**	**6.14**	total nitrogen
g/kg soil	**17.34**	**17.12**	**16.65**	**16.40**	Available phosphorous
	35.45	**33.21**	**30.23**	**29**	soluble potassium
	Z3	**Z2**	**Z1**	**Z0**	Soil Separators
	756	**742**	**740**	**738**	sand
	182	**180**	**179**	**177**	silt
g.kg $^{-1}$	**70**	**68**	**66**	**62**	Clay
Sandy loam					Texture

Bio-health WSG preparation

The bio-inoculation(Bio-health WSG) was used table (2). The process of adding the bio-inoculation began 21 days after transferring the seedlings to the pots and was added according to the manufacturer's recommendation, which is 1,250 kg. dunums, i.e. 0.02 gm. every 21 days.The addition was made after weighing the desired amount and dissolving it with distilled water, taking into account that the soil of the pots is semi-moist, with an emphasis on stirring it before adding in a simple way so that the bio-inoculation reaches the root area of the plants

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Table (2) shows the components of the bio-health WSG.

Contents	percentage
Trichoderma harzianum + Bacillus subtilis	10%
humic acid	75%
sea algae	5%
Humidity	10 -20%
water soluble potassium (k20)	11%
Boron	15%
Cation exchange capacity	400 / /meq 100g
Organic materials	65%
The percentage of water-insoluble substances with alkaline percentage	0.1>%

It included four levels: treatments of the first factor

1-Soil +3% (decomposed sheep manure) of the weight of the potting soil (control treatment) and symbolized by Z0

2-Soil + zeolite 3 g. kg^{-1} Soil + 3% decomposed sheep manure and symbolized by Z1

3-Soil + zeolite 6 g. kg^{-1} Soil + 3% decomposed sheep manure and symbolized by Z2

4- Soil + zeolite 9 g. kg^{-1} soil + 3% decomposed sheep manure and symbolized by Z3

The second factor: the bio inoculum (Bio-healthWSG)

It included the addition of the BiohealthWSG vaccine on two levels:

1-Without addition (B0)

2- Add the vaccine at a concentration of 0.02 g. Pot and symbolizes (B1)

experimental design

The experiment was implemented as a Factorial Experiment according to a Completely Randomized Design (C.R.D) and with three replicates. The Genstat program was used to conduct the statistical analysis. The means were compared for all study indicators according to the least significant difference (L.S.D) under the probability level of 5% (Al-Rawi and Khalaf Allah (2000)

Studied traits:

plant height cm

The plant height was measured from the soil surface to the highest plant height using a metric tape measure for three plants for each

Service and controlling operations

With the beginning of the process of preparing lathhouse, it was spread with polyethylene to prevent the growth of weeds. The plants were covered with polyethylene in the cold days, and the covering process continued until the time of flowering of the plant and moderate temperatures. Plant service operations were followed up, including weeding and control whenever needed, until the end of the experiment. As for the watering operations, they were conducted by means of an irrigation and drip system.

Setting up the drip irrigation system

The drip irrigation system was used in the irrigation process, where it was equipped with a plastic tank with a capacity of 5000 liters to ensure reserve water storage connected to the main pipe feeding the branch pipes. The system included a mechanical pump and a main pipe with a diameter of 3 inches. The system was equipped with a main control switch, and the sub-pipes were connected to the main, and the sub-pipes were plastic tubes with a diameter of 0.5 inch, and the distance between one droplet and another was 25 cm. The sub-pipes were equipped with a control switch to control irrigation

experiment factors

The experiment included three factors:

The first factor: Zeolite

The zeolite was obtained from the green lightning zeolite manufacturer, Amman, Jordan

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of the diluted mobile was taken and 1 ml of 5% phenol solution was added to it and 5 ml of concentrated sulfuric acid, then the optical absorption was read by a Spectrophotomrter at a wavelength of 560 nm, and the soluble carbohydrates were estimated Based on the standard curve for pure glucose prepared by dissolving different concentrations of glucose 2, 4, 6, 8, 10 mg in 100 ml of distilled water, then the optical absorption readings were taken at a wavelength 560 nm for each solution and the data were recorded to make the standard curve for glucose and then calculated .The percentage of dissolved carbohydrates. It was measured in the laboratories of the Department of Plant Production Techniques / Musayyib Technical College

Carbohydrates (mg.100gm fresh weight)=concentration/(sample weight x1ml x100)

Results and discussion

plant height (m):

The results in Table 3 showed that the zeolite added to the agricultural medium had a significant effect on the plant height trait, where The adding zeolite at a level 9 g. kg^{-1} treatment significantly excelled on the rest of the levels by recording the highest values of 82.9 cm, followed by the treatment of 6 $g.kg^{-1}$ and it gave 71.40 cm compared to the treatment of no addition, which recorded 61.3 cm. The table also shows the bio-inoculum treatment with a concentration of (0.02 ml/L) and it gave the highest value of 74.5 cm compared to the control treatment which recorded 67.1 cm. Also, the interaction treatment (zeolites 9 g/kg + bio-fertilizer 0.02 ml/L) significantly excelled and gave the highest average of plant height, which was 91.6 cm. It was followed by treatment (zeolites 6 g/kg + bio-fertilizer 0.02 ml/l) and it gave 73.60 cm compared to the control treatment, which recorded the lowest average of plant height of 59.2 cm.

experimental unit, then the averages were calculated for each treatment.

Number of leaves (leaf. Plant $^{-1}$)

The number of leaves for three plants in the experimental unit was calculated from the place of pruning to the top of the plant, then the averages were extracted for each treatment

Intensity of chlorophyll pigment in leaves (Spad unit)

Three leaves were collected from each of the bottom, middle and top of the plant for two branches for each plant and it was estimated using the SPAD-502 Model chlorophyll meter) and for three plants and the averages were extracted for each treatment.

Fresh weight and percentage of dry matter in leaves %

The leaves of the second and third pair were collected at the bottom of the growing apex at the beginning of the plant reaching the flowering stage of each experimental unit and measured after taking its fresh weight first and then dried in an electric oven at a temperature of 70 °C for 48 hours and until the weight was stable and the percentage of dry matter of the plant was calculated (Al-Sahaf, 1989).) According to the following equation:

Dry matter percentage%=$\frac{dry\ weight\ of\ leaves}{fresh\ weight} \times 100$

Leaves content of total carbohydrates mg 100 g^{-1} fresh weight

The total carbohydrate content of the leaves was estimated according to the method mentioned by Joslyn), (1970, as A dried and ground sample weighing 0.2 g was taken from each treatment and 8 ml of ethyl alcohol was added to it at a concentration of 80%, then placed in a water bath at 60 degrees for 30 minutes, then the expulsion process was performed Central for 15 minutes at a speed of 3000 rpm/ sec and withdraw the filter and repeat these steps three times. Then collect the clear liquid (the leachate) in a volumetric flask and complete the volume to 25 ml by adding Ethyl alcohol was taken and 1 ml

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Table 3. Effect of zeolites , bio-inoculum and their interactions on plant height (cm) of Rosa hybrid plant

average	Bio-fertilizer		Zeolite (g/kg)
	Add 0.02 ml/L	without adding	
61.3	63.3	59.2	0
67.6	69.6	65.7	3
71.4	73.6	69.3	6
82.9	91.6	74.2	9
	74.5	67.1	average
interaction	Bio-fertilizer	Zeolite	LSD
4.81	2.41	3.40	

number of leaves was 34.8 leaf .plant-1.The addition of the bio-inoculum at an average 0.02 ml / L had a significant effect on increasing the number of leaves amounted to 44.8 leaf .plant^{-1}. The interaction treatment (zeolites 9 g/kg + bio-fertilizer 0.02 ml/L) also excelled and gave the highest number of leaves amounted 50.0 leaf .plant-1 compared to the control treatment, which recorded the lowest average number of leaves, which was 32.7 leaf .plant^{-1}

2- The number of leaves, (leaf. Plant $^{-1}$)

Table 4, we note that the addition of zeolite has a significant effect on increasing the number of leaves, where the treatment of 9 g. kg $^{-1}$ was recorded the highest average of the number of leaves reaching 48.7 leaf .plant^{-1} . It was followed by a treatment of 6 g.kg^{-1}, which gave an average number of leaves that amounted to 46.7 leaf .plant^{-1}, compared to the control treatment, which recorded the lowest average of the

Table4. Effect of zeolites , bio-inoculum and their interactions on the leaves number (leaf .plant^{-1}) of Rosa hybrid plant

average	Bio-fertilizer		Zeolite) g/kg(
	Add 0.02 ml/L	without adding	
34.8	37.0	32.7	0
42.3	44.7	40.0	3
46.7	47.3	46.0	6
48.7	50.0	47.3	9
	44.8	41.5	average
interaction	Bio-fertilizer	Zeolite	LSD
3.65	1.82	2.58	

addition of the bio-inoculum at an average of 0.02 ml/L had a significant effect on increasing the intensity of chlorophyll pigment in the leaves and it gave 39.90 spad unit, while the non-addition treatment recorded the lowest average of the intensity of chlorophyll pigment in the leaves, which amounted to 37.4 spadunit. Also, the treatment of the interaction (zeolites 9 g/kg + bio-fertilizer 0.02 ml/L) excelled and gave a higher intensity of chlorophyll pigment in the leaves, and gave 37.4 spadunit Compared to the control treatment, which recorded the lowest average of chlorophyll pigment intensity in the leaves, it was 34.0 spadunit

3- Intensity of chlorophyll pigment in leaves (Spad unit)

Table 5, we notice that the addition of zeolite has a significant effect in increasing the intensity of chlorophyll pigment in the leaves, where the treatment of 9 g. kg^{-1} recorded the highest average of intensity of chlorophyll pigment in the leaves amounting to 44.1 spad unit, It was followed by a treatment of 6 g.kg^{-1} and it gave an average of the intensity of chlorophyll pigment in the leaves that amounted to 38.8 spad unit compared to the control treatment that recorded the lowest average of the intensity of chlorophyll pigment in the leaves of 35.00 spadunit. The

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Table 5. Effect of zeolite , bio-inoculum and their interaction on the intensity of chlorophyll pigment spadunit of Rosa hybrid leaves

average	Bio-fertilizer		Zeolite) g/kg(
	Add 0.02 ml/L	without adding	
35.0	36.0	34.0	0
36.5	37.0	36.0	3
38.8	39.1	38.6	6
44.1	47.4	40.9	9
	39.9	37.4	average
interaction	Bio-fertilizer	Zeolite	LSD
2.02	1.01	1.43	

inoculum at an average of 0.02 ml / L had a significant effect on increasing the wet weight of leaves, and it gave the highest average of 1.2 While the non-addition treatment recorded the lowest average leaf wet weight of 1.1 g, the interaction treatment (Zyolates 9 g/kg + bio-fertilizer 0.02 ml/L) was excelled and gave the highest leaf fresh weight of 1.4 g Compared to the control treatment, which recorded the lowest fresh weight of the leaves was 0.8 g

4- fresh weight of leaves

The results in Table 5 showed the significant effect of adding zeolite in increasing the fresh weight of the leaves (gm),The treatment of 9 g. kg $^{-1}$ was significantly excelled on the rest of the other treatments and gave the highest average leaf wet weight of 1.3 g, followed by treatment of 6 g. kg $^{-1}$ and it gave an average leaf wet weight of 1.2 g. Compared to the control treatment, which recorded the lowest average fresh weight of leaves, it was 0.9 g, and the addition of bio-

Table (5). Effect of zeolite and bio-fertilizer and their interaction on the average fresh weight of leaves (gm) of Rosa hybrid plant

average	Bio-fertilizer		Zeolite) g/kg(
	Add 0.02 ml/L	without adding	
0.9	1.0	0.8	0
1.0	1.1	0.9	3
1.2	1.3	1.1	6
1.3	1.4	1.1	9
	1.2	1.0	average
interaction	Bio-fertilizer	Zeolite	LSD
0.08	0.04	0.06	

-

g.kg^{-1} and it gave an average of the percentage of dry matter of leaves amounted to 0.4% Compared to the control treatment, which recorded the lowest percentage of leaf dry matter percentage of 0.3%, and the addition of bio-inoculum at a rate of 0.02 ml/L had a significant effect in increasing the percentage of leaf dry matter (%) and gave the highest average

5Percentage of dry matter of leaves(%)

The results in Table 6 showed the significant effect of adding zeolite in increasing the percentage of dry matter of leaves (%),The treatment of 9 g.kg^{-1} was significantly excelled on the rest of the other treatments and gave the highest percentage of dry matter percentage of leaves that was 0.5%, followed by treatment of 6

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highest percentage of dry matter of leaves which was 0.6%.Compared to the comparison treatment, which recorded the lowest percentage of dry matter for leaves, it was 0.3%.

of 0.5% While the non-addition treatment recorded the lowest percentage of dry matter percentage of the leaves amounted to 0.4%. Also, the interaction treatment (Zeolite 9 g/kg + bio-fertilizer 0.02 ml/L) was excelled and gave the

Table6. Effect of zeolites ,bio inoculum and their interaction on the percentage of leaf dry matter (%) of Rosa hybrid plant

average	Bio-fertilizer		Zeolite) g/kg(
	Add 0.02 ml/L	without adding	
0.3	0.4	0.3	0
0.4	0.4	0.3	3
0.4	0.4	0.4	6
0.5	0.6	0.4	9
	0.5	0.4	average
interaction	Bio-fertilizer	Zeolite	LSD
0.06	0.03	0.04	

weight^{-1}, the addition of the bio-inoculum at an average of 0.02 ml/L had a significant effect on increasing the leaves' content of total carbohydrates and gave the highest average of 10.0 mg.100 g dry weight^{-1} While the non-addition treatment recorded the lowest average of the leaves content of total carbohydrates amounted to 9.3, and the interaction treatment (zeolite 9 g/kg + bio-inoculum 0.02 ml/L) was excelled and it gave a higher content of leaves of total carbohydrates amounting to 12.7 mg.100 g dry weight^{-1} compared to the control treatment which recorded less content of leaves of total carbohydrates amounting to 7.5 mg.100 gm dry weight^{-1}

6- Leaves content of total carbohydrates(mg.100 g dry weight^{-1})

The results in Table 8 showed the significant effect of adding zeolite in increasing the total carbohydrate content of the leaves (mg.100g dry weight^{-1}). The treatment of 9 g.kg^{-1} significantly excelled on the rest of the other treatments and gave the highest average content of leaves of total carbohydrates amounting to 12.2 mg.100 g dry weight^{-1}, Followed by the treatment of 6 g.kg^{-1} and it gave an average content of the leaves of total carbohydrates amounted to 10.1 mg.100 g dry weight^{-1} Compared to the control treatment, which recorded the lowest average for the leaves content of total carbohydrates 7.7 mg.100 g dry

Table 8. Effect of zeolite and bio-inoculation and their interaction on the leaves content of total carbohydrates mg.100 g.dry weight^{-1}. Rosa hybrid plant

average	Bio-fertilizer		Zeolite) g/kg(
	Add 0.02 ml/L	without adding	
7.7	7.9	7.5	0
8.6	8.8	8.4	3
10.1	10.7	9.6	6
12.2	12.7	11.7	9
	10.0	9.3	average
interaction	Bio-fertilizer	Zeolite	LSD
0.49	0.25	0.35	

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in the decomposition of organic matter and the formation of organic-mineral complexes with micro-elements (Zn-Mn-Fe), which increased its readiness due to the reduction of the degree of soil interaction (ph) This fungus also works to produce stimuli and regulators of growth and the formation of mechanisms to defend the plant, which contributes significantly to increasing the readiness of nutrients in the root area and then easy absorption by the plant (Sharma et al., 2012) These fungi also extend several centimetres from the surface of the roots and work to withdraw nutrients from the outer area of the infected roots (Demir 2004, Al-Wahaibi, 2008). Bacillus bacteria also had an important role in increasing the growth parameters mentioned above, as it is part of the biological fertilizer and is characterized by its ability to increase the solubility of phosphorus in the soil. Converting unready images into ready-to-sorption images by producing different types of organic acids such as oxalic and citric, which dissolve insoluble phosphate compounds and thus increase their readiness, and this is consistent with (Dawwan et al., 2013). Studies indicate that there is a close relationship between the amount of chlorophyll in the leaves and the accumulation of nitrogen in the dry matter, as the content of chlorophyll is an indicator of the extent of nitrogen absorption from the soil (Ruiz et al., 2000) and the increase in the fresh weight of the plant may be due to the added biofertilizer containing humic acid, which increases the permeability of nutrients by increasing the permeability of the living membranes in the roots, which improves their absorption of nutrients (Arancon et al., 2006). It also works to reduce Fe + 3 to Fe + 2 and chelate iron. In addition, the increase in atmospheric nitrogen fixation has become clear in the treatment of bio-fertilizer. As the percentage of nitrogen increased, and this led to an increase in the process of carbonization, as nitrogen leads to an increase in the speed of plant growth by increasing the speed of cell division, which increases the biomass of the plant (Taha, 2007).The increase in nitrogen was reflected in the increase in the building of chlorophyll (table 5), which led to an increase in the number of

The increase in vegetative growth is due to the effect of adding zeolite to the growth media of the Rosa hybrid plant, and this was shown by the results in Table (3,8). The reason for this may be due to the high ability of the plant to absorb water and nutrients and their role in metabolism. As the leaf area develops in the stage of vegetative growth, which in turn is affected by the good preparation of water and nutrients, and the zeolite works to provide the ammonium sorbent element on the surfaces of zeolite, which is one of the forms of nitrogen that increases cell division and increases meristematic activity (Ayan et al., 2005). Phosphorous also contributes to cell division and an increase in the vegetative growth, which leads to increased absorption. In addition, potassium activates many enzymes, which improves plant metabolism and delays senescence . It increases the efficiency of chlorophyll and photosynthesis and thus leads to an increase in the rates of production and representation of dry matter and encourages vegetative growth (Al-Maamouri, 2016). The results also indicated that zeolite improved the growth indicators studied, represented by plant height (Table 3), the percentage of chlorophyll (4), and the carbohydrate content of leaves .Whereas, the addition of zeolite has improved soil aeration and the physical and chemical properties of the soil due to the abundance of its pores and the slow release of nutrients to the plant due to its high ability to cation exchange (Altemymy, 2019). Also, the bio-fertilizers had a significant effect on the vegetative growth traits , the results showed the excelled of the treatment (0.02 ml/L) of adding the bio-fertilizer represented by (Bio-health WSG).The reason for this increase may be due to its role in improving the physical and chemical properties of the soil, as well as increasing the surface area of the roots and stimulating the root hairs to absorb the nutrients in the soil as a result of releasing plant hormones in the growth medium such as auxins and gibberellins, which work on cell division and increase their numbers (Wu et al., 2015).The reason for the increase in these traits may be due to the fact that the bio-fertilizer contains a fungus Trichodermassp, which played an important role

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leaves in the plant and thus reflected in the leaf area of the plant, and the increase in the leaf area led to an increase in the accumulation of carbon-building products, which was reflected in the increase in the height of the plant (Table 3)and the increase of dry matter in table (7) and carbohydrates in the leaves table (8)The aforementioned bio-fertilizer also contains marine algae extracts, which contain Betaines (Ali et al.,2015).It is one of the important catalysts for building chlorophyll, and this is reflected in an increase in the proportion of carbon metabolism and thus the production of different compounds in the plant, and this is what was agreed upon (Sumengala et al., 2019, Alhamzawi-2019). Also, biofertilizers played an important role in increasing the readiness, movement and solubility of nutrients, and then their absorption (Hayat et al., 2010). These beneficial microorganisms work to settle the roots in the rhizosphere, which leads to the stimulation of enzymes such as (protease-phosphatase) (Shaharan and Nehra), 2011), which increases the availability of the elements as a result of the mineralization process and prevents their fixation through the formation of complexes with them (Agbede et al., 2008).

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