Study the addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer on some chemical traits on grapevine " French black" cultivar.

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Abstract

The experiment was conducted on a French black grape cultivar in a private orchard in Babylon province/ Al-Hamzah Al-Gharbi district, and the experiment was conducted using the factorial design of the Randomized Complete Block Design (RCBD) with three replicates with three factors. The first factor is adding biofertilizer consisting of Bacillus megaterium and Mycorrhiza glomus fungus at two levels (0 and 10 ml L^{-1}) to the soil, and the second factor is adding liquid organic fertilizer at a concentration (0, 15 and 30 ml L^{-1}) to the soil, and the third factor is foliar spraying with nano organic fertilizer at a concentration of (0,1 and 3 ml L^{-1}) for both seasons (2020-2021). The experiment included (54) vines for the cultivar, and the averages were compared by testing the least significant difference (L.S.D) at the level of probability 0.05 (Al-Rawi and Khalaf Allah, 2000) and using the statistical program GenStat .The most important results that were reached were summarized as follows: While the results indicated that there was a significantly excelled with regard to biofertilization at a concentration of 10 ml L^{-1} in most of the chemical indicators, where it led to an increase in the percentage of phosphorus in the leaves by 0.43 and 0.44%, the percentage of total soluble solids in the juice of the berry s, as it reached 15.19 and 14.46%, The percentage of total acidity in berry juice was 0.74 and 0.99%.The percentage of total soluble solids/total acidity amounted to 32.5 and 27.6%, the percentage of reducing sugars in berry juice amounted to 8.02 and 7.24% for the two seasons, respectively,.The organic fertilizer at a concentration of 30 ml L^{-1} had a significant effect on the trait of the phosphorus percentage in the leaves, 0.392 and 0.475 %, for both seasons, respectively. The percentage of total soluble solids/total acidity amounted to 37.6 and 30.3% for both seasons, respectively...

Keywords: grapevine , biofertilizer, nano-organic fertilizer, liquid organic fertilization, chemical fruit indicators, phosphor leaves content .

introduction

grape, *Vitis vinifera* L., belongs to the Vitaceae family, which includes 14 genera, the most important of which is the genus Vitis, which is widely cultivated in the world. This family includes more than 1,000 species. Grape shrubs are perennial,.However, the commercial of grape farms is usually between 30 and 50 years[14]. Researchers believe that the origin country of grapes is Central Asia, while others assert that it is the Mediterranean basin and the Caucasus .The latest statistics of the World Food and Agriculture Organization[13] showed that the global production of grapes was 112,265 ton per hectare, which equals (11.226 5 Mg. ha^{-1})In Iraq, the production of grapes, according to the statistics of the Central Agency for Agricultural Statistics for the year 2021, was estimated at 421,868 Mg. $ha^{-1}$for the summer season, and it increased by 0.33% from the previous season[2]. Recent studies have tended to reduce the added quantities of

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mineral fertilizers by using means that lead to an increase in their availability in the soil and their absorption by plants easily to increase production, and the most important means is biofertilization[23]. It is one of the methods aimed at reducing the irrational use of mineral fertilizers, reducing environmental pollution sources and production costs, increasing soil fertility, and increasing crop quality. Biofertilizers increase the availability of nutrients by fixing nitrogen, dissolving phosphate compounds, and facilitating potassium Biofertilizer is a material that contains microorganisms that, when applied to seeds or soil, colonize the terrestrial biome (the rhizosphere) and stimulate growth by increasing the supply or readiness of the main nutrients for the host plant and the soil[17]. Nanofertilizers have unique properties such as increasing the absorption of nutrients and raising the efficiency of the photosynthesis process by increasing the chlorophyll molecule, thus increasing the leaf surface area and increasing production, in addition to increasing the plant's ability to withstand different stress conditions and plant resistance to diseases [24].The organic matter in the soil is the accumulation of partially or completely decomposed plant and animal parts and various animal wastes, consisting of microorganisms, fallen leaves and dead plant roots that quickly decompose and become part of the soil humus, which remains for a long time and is the effective part of the soil [8] . The organic matter is given to the soil after its complete decomposition and the nutrients it contains in a form suitable for absorption by the roots of trees. The main condition for its decomposition in the soil is the availability of sufficient numbers of microorganisms and the availability of appropriate conditions for the growth and activity of these organisms. Plants grown in a certain soil will not benefit from the organic matter present in the soil except after decomposition and transformation into formulas, compounds, and elements that can be absorbed by the roots of plants [5].Recently, there has been an increase in consumer demand for certified organic agricultural products, and the recent global trend is focused on the use of organic and natural sources of all kinds in fertilization, including the use of a number of different biological stimuli of organic origin, and the stimuli differ in their nutrient content .As the organic biocatalyst is a mixture of residual materials from plant or animal organisms and microorganisms that resulted during the process of their partial or complete decomposition for a long period of time [22].was found that the use of low concentrations of these stimulants sprayed on the shoots or added to the irrigation water had clear positive effects in increasing the vegetative growth and improving the yield, [10

MATERIALS AND METHODS

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Table (1) Physical and chemical properties of field soil before application

Values		Units	traits
Second season	**First season**		
7.8	8.3	- - -	pH
3.4	4.6	$DS.m^{-2}$	electrical conductivity EC
2.0	1.10	%	organic matter
12.2	11.4	$mg.kg^{-1}$	nitrogen
5.3	5.6	$mg.kg^{-1}$	phosphorous
186.3	189.0	$mg.kg^{-1}$	potassium
600	600	$g.kg^{-1}$	sand
245	245	$g.kg^{-1}$	silt
155	155	$g.kg^{-1}$	clay
sandy loam		**Texture**	

study factors

fertilization

The experiment treatments was done and replicate on four dates (15/3, 15/4, 15/5 and 15/6) with a period of two days between one addition and another The experiment included three factors :

* The first factor is the addition of biofertilizer consisting of Bacillus megaterium and Mycorrhiza glomus fungus at two levels (0 and 10 ml L^{-1}) to the soil in the root growth zone[19].

* The second factor is the addition of liquid organic fertilizer at a concentration of (0, 15 and 30 ml L^{-1}) to the soil in the Rhizosphere growth zone.

* The third factor is the foliar spraying of nano-liquid organic fertilizer with a concentration of (0, 1, and 3 ml L^{-1}). The plants were sprayed early in the morning.

The following experimental measurements were recorded

1-Leaves content of elemental phosphorous (%):

The phosphorus content of the leaves was calculated according to the method [11]. by weighing 0.5 g of the crushed and dried sample, which was soluble in (5 ml) of sulfuric acid and (2 ml) of perchloric acid. Ammonium molybdate and ascorbic acid were used (colorimetric method) and then measured using a spectrophotometer (type Bichrom - Libra S22 - UK 2005) at a wavelength of 700 nm.

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2-Determination of the percentage of total soulible solids in berry juice (T.S.S) (%):

The total soluble solids of the juice were determined by direct reading in a Refractometer ("Brix") according to Method No. 315/IV.

3-Estimation of the percentage of total acidity in berry juice (%):

TTA measured as a percentage of citric acid was determined by titration with 0.1 N NaOH solution and phenolphthalein index method No. 310/IV.

4-Estimation of Total soluble Solids Percentage/Total Acidity (T.S.S/T.A) (%):

It was calculated by dividing the percentage of soluble solids by the percentage of total acidity of the fruits.

5-Determination of the percentage of reducing sugars in berry juice (%):

5 grams of each sample were weighed, then transferred to volumetric flasks of 100 ml, and filled up to the mark with distilled water, then placed in a water bath for 30 minutes, then the flasks were filtered using filter paper, then the filtrate of each flask was transferred to another volumetric flask of 250 ml, and filled to the mark. with distilled water, 50 ml of the solution prepared by pipette was transferred to volumetric flasks of 100 ml capacity and completed to the mark with distilled water, then the burette was filled with the diluted solution, then 15 ml of the burette was transferred into a conical flask and 12.5 ml of Fehling A and 12.5 ml of Fehling B were added to it by means of the measuring cylinder. The color of the solution turned blue, then the flask was placed on the flame until the color turned "brick red".

Then two drops of methyl blue index were added to it and the flask was weighed against the solution in the burette until the endpoint. The reading from the burette was recorded and the percentage of reducing sugars was calculated.

Fehling's solution: This solution consists of an equal mixture of "A" solution and "B" solution, and the two are mixed before use.

Solution A: 69.38 g of copper sulfate (CuSO4.5H200) was weighed and soluble in water, then diluted to one liter in a volumetric flask.

Solution "B": 3466g of Rochelle salt (potassium sodium tartrate KNaC4H406.4H20) and 100g of sodium hydroxide were weighed and soluble in a 1000ml volumetric flask, diluted to the mark, and then filtered through glass wool.

Methylene blue solution: 1gm of dye was taken and soluble in 1000ml water.

$$\text{Sugars \%} = \frac{\text{Dilution x table equivalent of invert sugar}}{\text{Model weight x scan volume}} \times 100$$

Results and discussion

Leaves phosphorous content (%)

It was observed through the results in table (2) that there was a significantly excelled when adding bio-fertilizer, as it gave the highest value for the phosphorus content of the leaves at the level of 10 ml L^{-1} amounted to 0.438%, compared to the treatment of no addition, which gave the lowest value of 0.239%. As for spraying with nano-organic fertilizer, it showed a significantly excelled, as it gave the highest value for the phosphorus content of the leaves at a concentration of 3 ml / liter, which amounted to 0.394%. Compared to the no-spray treatment, which gave the lowest value of 0.285%. The results indicate that the treatment of adding organic fertilizer was significantly excelled, where it gave the highest value for the phosphorus content of the

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leaves at the level of 30 ml L^{-1} amounted to 0.392%, compared to the treatment of no addition, which gave the lowest value of 0.263%.It was observed that the bi- interaction between the nano-organic fertilizer and the organic fertilizer was significantly excelled by giving it the highest value for the leaf content of phosphorus at the level of 30 x 3 ml L^{-1}, which amounted to 0.460%. Compared to the non-additive treatment, which gave the lowest value of 0.220%, for the bi-interaction between biofertilizer and organic fertilizer, it showed a significantly excelled in the phosphorus content of the leaves by giving it the highest value at the level of 10 x 30 ml L^{-1} .

539%.Compared to the control treatment, which gave the lowest value of 0.117%. amounting to 0.486%.Compared to the non-adding treatment, which gave the lowest value of 0.162%, for the bi- interaction between bio-organic and nano-fertilizers, it was significantly excelled by giving it the highest value for the leaf phosphorus content at the 3 x 10 ml L^{-1} level of 0.487% compared to the non-adding treatment, which gave the lowest value of 0.178. %.The results of the table below indicated that the triple interaction between bio-fertilizer, nano-organic fertilizer and organic fertilizer gave the highest value for the leaf phosphorus content at the level of 10 x 3 x 30 ml L^{-1}, which amounted to 0

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Table (2) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in leaf content of phosphorus % for the first season2020

	bio fertilizer		**nano organic fertilizer ml.L-1**	**organic fertilizer ml.L-1**
	10	**0**		
	0.322	0.117	**0**	**0**
	0.416	0.190	**1**	
	0.436	0.227	**3**	
=0.008organic fertilizer L.S.D.	0.359	0.160	**0**	**15**
=0.008nano organic fertilizer L.S.D.	0.469	0.260	**1**	
=0.007bio fertilizer L.S.D.	0.482	0.290	**3**	
	0.412	0.210	**0**	**30**
	0.509	0.313	**1**	
	0.539	0.380	**3**	
	0.438	0.239	**bio fertilizer average**	
=0.020organic fertilizer × nano organic fertilizer bio fertilizer = L.S.D				
Average organic fertilizer	**nano organic fertilizer**			**organic fertilizer**
	3	**1**	**0**	
0.263	0.311	0.260	0.220	**0**
0.360	0.411	0.365	0.303	**15**
0.392	0.460	0.386	0.331	**30**
	0.394	0.337	0.285	**Nano organic fertilizer average**
=0.014organic fertilizer × nano organic fertilizer= L.S.D				
	bio fertilizer		**organic fertilizer**	
	10	**0**		
	0.365	0.162	**0**	
	0.465	0.255	**15**	
	0.486	0.299	**30**	
	0.438	0.239	**bio fertilizer average**	
=0.011organic fertilizer × bio fertilizer = L.S.D				
	bio fertilizer		**nano organic fertilizer**	
	10	**0**		
	0.391	0.178	**0**	
	0.437	0.237	**1**	
	0.487	0.301	**3**	
	0.438	0.239	**bio fertilizer average**	
=0.011nano organic fertilizer × bio fertilizer = L.S.D				

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Through the results of Table (3) for the second season, it was shown that there was a significantly excelled when adding bio-fertilizer, which gave the highest value for the phosphorus content of the leaves at the level of 10 ml L^{-1} amounted to 0.445%, compared to the no-add treatment, which gave the lowest value of 0.405%. in the case of spraying with nano-organic fertilizer, It was significantly excelled by giving it the highest value for the phosphorus content of the leaves at a concentration of 3 ml L^{-1}, which amounted to 0.470%. Compared to the no-spray treatment, which gave the lowest value of 0.377%. The addition of organic fertilizer gave the highest value for the phosphorus content of the leaves at the level of 30 ml $L^{-1,}$ amounting to 0.475%, compared to the no-adding treatment, which gave the lowest value of 0.349%. Whereas, it was found that the bi-interaction between the nano-organic fertilizer and the organic fertilizer had a significantly excelled by giving it the highest value for the leaf content of phosphorus at the level of 30 x 3 ml L^{-1}, which amounted to 0.520%.Compared to the non-additive treatment, which gave the lowest value of 0.263%, it was observed that the bi-interaction between the bio-fertilizer and the organic fertilizer gave the highest value for the phosphorus content of the leaves at the level of 10 x 30 ml L^{-1}, amounting to 0.493%, compared to the non-additive treatment, which gave the lowest value of 0.338%. The results indicated that the bi- interaction between bio-fertilizer and nano-organic gave the highest value of phosphorous content of the leaves at the level of 10 x 3 ml L^{-1} amounted to 0.486%, compared to the non-adding treatment, which gave the lowest value of 0.350. %.The results of Table (2) showed that there was a significantly excelled in the case of the triple interaction between bio-fertilizer, nano-organic fertilizer and organic fertilizer, as it gave the highest value for the leaf content of phosphorus at the level of 10 x 3 x 30 ml L^{-1} amounting to 0.543% compared to control treatment, which gave the lowest value of 0.236%.

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Table (3) effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer , and the interaction between them on leaf content of phosphorus % for the second season2021

	bio fertilizer		**nano organic fertilizer ml.L-1**	**organic fertilizer ml.L-1**
	10	**0**		
	0.290	0.236	**0**	**0**
	0.343	0.363	**1**	
	0.446	0.416	**3**	
	0.510	0.370	**0**	**15**
	0.470	0.443	**1**	
	0.470	0.450	**3**	
	0.413	0.443	**0**	**30**
	0.523	0.443	**1**	
	0.543	0.496	**3**	
=0.034organic fertilizerL.S.D. =0.034nano organic fertilizerL.S.D. = 0.027 bio fertilizerL.S.D.	0.445	0.405	**bio fertilizer average**	
=0.083organic fertilizer × nano organic fertilizer bio fertilizer = L.S.D				
Average organic fertilizer	**nano organic fertilizer**			**organic fertilizer**
	3	**1**	**0**	
0.349	0.428	0.440	0.263	**0**
0.452	0.478	0.456	0.353	**15**
0.475	0.520	0.460	0.431	**30**
	0.470	0.429	0.377	**Nano organic fertilizer average**
=0.058organic fertilizer × nano organic fertilizer= L.S.D				
	bio fertilizer		**organic fertilizer**	
	10	**0**		
	0.360	0.338	**0**	
	0.483	0.421	**15**	
	0.493	0.457	**30**	
	0.445	0.405	**bio fertilizer average**	
=0.048organic fertilizer × bio fertilizer = L.S.D				
	bio fertilizer		**nano organic fertilizer**	
	10	**0**		
	0.404	0.350	**0**	
	0.445	0.413	**1**	
	0.486	0.454	**3**	
	0.445	0.405	**bio fertilizer average**	
=0.048nano organic fertilizer × bio fertilizer = L.S.D				

Determination of the percentage of total soluble solids (TSS) in berry juice (%)

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The results of Table (4) showed that there was a significantly excelled when adding biofertilizer, which gave the highest value for the percentage of total soluble solids in the juice of the berries at the level of 10 ml L^{-1}, which amounted to 15.19%.Compared to the no-adding treatment, which gave the lowest value of 13.85%, it was clear from the results that the nano-organic fertilizer spraying treatment was significantly excelled by giving it the highest value for the percentage of total soluble solids in the berries juice at a concentration of 3 ml L^{-1}, which amounted to 14.8% compared to the no-spray treatment, which It gave the lowest value of 14.20%.As for the addition of organic fertilizer, it gave the highest value for the percentage of total soluble solids in the juice of the berries at the level of 30 ml L^{-1} amounted to 14.90%, compared to the treatment of no addition, which gave the lowest value of 14.03%.The results showed that the bi-interaction between the nano-organic fertilizer and the organic fertilizer was significantly excelled as it gave the highest value for the percentage of total soluble solids in the berries juice at the level of 30 x 3 ml L^{-1}, which amounted to 15.33%, compared to the non-adding treatment, which gave the lowest value of 13.78%.As for the bi-interaction between the bio-fertilizer and the organic fertilizer, it showed a significantly excelled by giving it the highest value for the percentage of total soluble solids in the berries juice at the 10 x 30 ml L^{-1} level, which amounted to 15.50%, compared to the non-adding treatment, which gave the lowest value of 13.33%, which appeared through Results The bi-interaction between bio-fertilizer and nano-organic fertilizer was significantly excelled, as it gave the highest value for the percentage of total soluble solids in the berries juice at the level of 10 x 3 ml L^{-1} amounted to 15.48%, compared to the non-adding treatment, which gave the lowest value of 13.46%.The results of the table below indicated that there was a significantly excelled in the case of the triple interaction between bio-fertilizer, nano-organic fertilizer and organic fertilizer, as it gave the highest value for the percentage of total soluble solids in the berries juice at the level of 10 x 3 x 30 ml L^{-1}, which amounted to 15.84% compared to control treatment, which gave less a value of 13.03%.

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Table (4) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in the percentage of total soluble solids (TSS) in berries juice (TSS) % for the first season2020

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	**0**		
		14.53	13.03	**0**	**0**
		15.04	13.46	**1**	
		15.22	13.89	**3**	
		14.68	13.27	**0**	**15**
		15.36	14.01	**1**	
		15.46	14.17	**3**	
		14.96	13.69	**0**	**30**
		15.65	14.27	**1**	
		15.84	14.82	**3**	
=0.019organic fertilizer L.S.D. =0.019nano organic fertilizer L.S.D. =0.016bio fertilizer L.S.D.		15.19	13.85	**bio fertilizer average**	
=0.047organic fertilizer × nano organic fertilizer bio fertilizer = L.S.D					
Average organic fertilizer		**nano organic fertilizer**			**organic fertilizer**
		3	**1**	**0**	
14.03		14.32	13.98	13.78	**0**
14.63		14.96	14.68	14.25	**15**
14.90		15.33	14.81	14.56	**30**
		14.87	14.49	14.20	**Nano organic fertilizer average**
=0.033organic fertilizer × nano organic fertilizer= L.S.D					
		bio fertilizer		**organic fertilizer**	
		10	**0**		
		14.72	13.33	**0**	
		15.35	13.92	**15**	
		15.50	14.29	**30**	
		15.19	13.85	**bio fertilizer average**	
=0.027organic fertilizer × bio fertilizer = L.S.D					
		bio fertilizer		**nano organic fertilizer**	
		10	**0**		
		14.93	13.46	**0**	
		15.16	13.82	**1**	
		15.48	14.26	**3**	
		15.19	13.85	**bio fertilizer average**	
=0.027nano organic fertilizer × bio fertilizer = L.S.D					

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The results of Table (5) indicated for the second season when adding biofertilizer gave a value for the percentage of the total soluble solids in the juice of the berries at the level of 10 ml L^{-1} amounted to 14.46% compared to the treatment to which nothing was added, as for the treatment of spraying with nano-organic fertilizer, it gave the highest value The percentage of total soluble solids in the juice of berries at a concentration of 1 ml L^{-1} was 14.59%Compared to the no-spray treatment, which gave a value of 14.55%. From the results, it was observed that the treatment of adding organic fertilizer was superior, where it gave the highest value for the percentage of total soluble solids in the berries juice at the level of 30 ml L^{-1}, which amounted to 14.66%, compared to the treatment of no addition, which gave a value of 14.58%.The results showed that the bi-interaction between the nano-organic fertilizer and the organic fertilizer gave the highest value for the percentage of total soluble solids in the berries juice at the level of 30 x 3 ml L^{-1} amounted to 14.68%, compared to the non-adding treatment, which gave a value of 14.36%, while the bi-interaction between the bio fertilizer And organic fertilizers, it gave the highest value for the percentage of total soluble solids in berries juice at the level of 10 x 30 ml L^{-1} amounted to 15.00%.Compared to the no-add treatment, which gave a value of 14.56%, the results showed that the bi-interaction between the bio-fertilizer and the nano-organic fertilizer gave the highest value for the percentage of total soluble solids in the berries juice at the level of 10 x 1 ml L^{-1} amounted to 14.64%, compared to the treatment that was not added. a thing.The results in table (4) showed that there was a significantly excelled in the case of the triple interaction between biofertilizer, nano-organic fertilizer and organic fertilizer, which gave the highest value of the percentage of total soluble solids in the berries juice at the level 0 x 3 x 30 ml L^{-1} amounted to 15.51% compared to control treatment that It gave a value of 14.73%.

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Table (5) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in the percentage of total soluble solids (TSS) in berries juice (TSS)% for the second season2021

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	0		
		13.99	14.73	0	0
		15.00	14.62	1	
		14.82	14.32	3	
		14.98	14.09	0	15
		14.06	14.76	1	
		14.29	13.80	3	
		14.27	15.26	0	30
		14.85	14.22	1	
		13.85	15.51	3	
=0.564organic fertilizerL.S.D. =0.564nano organic fertilizerL.S.D. =0.461 bio fertilizerL.S.D.		14.46	14.59	bio fertilizer average	
=1.382organic fertilizer × nano organic fertilizer bio fertilizer = L.S.D					
Average organic fertilizer		nano organic fertilizer			organic fertilizer
		3	1	0	
14.58		14.76	14.54	14.36	0
14.33		14.53	14.41	14.81	15
14.66		14.68	14.04	14.57	30
		14.43	14.59	14.55	Nano organic fertilizer average
=0.977organic fertilizer × nano organic fertilizer= L.S.D					
		bio fertilizer		organic fertilizer	
		10	0		
		14.61	14.56	0	
		14.45	14.22	15	
		14.32	15.00	30	
		14.46	14.59	bio fertilizer average	
=0.798organic fertilizer × bio fertilizer = L.S.D					
		bio fertilizer		nano organic fertilizer	
		10	0		
		14.41	14.69	0	
		14.64	14.54	1	
		14.32	14.54	3	
		14.46	14.59	bio fertilizer average	
=0.798nano organic fertilizer × bio fertilizer = L.S.D					

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Determination of the percentage of total acidity in berries juice (%)

Table (6) that the biofertilizer was significantly excelled by giving it the highest value for the percentage of total acidity in the berry juice at the level of 10 ml L^{-1} amounting to 0.74% compared to the no-adding treatment that gave the lowest value of 0.42%. It was clear from the results that the spraying treatment It was significantly excelled on organic fertilizers by giving it the highest percentage value of total acidity in berry juice at a concentration of 3 ml L^{-1}, which was 0.67%.Compared to the no-spray treatment, which gave the lowest value of 0.50%. The results showed that there was a significantly excelled when adding organic fertilizer, which gave the highest value of the percentage of total acidity in the juice of berries at the level of 30 ml L^{-1} amounted to 0.68%, compared to the treatment of no addition, which gave the lowest value of 0.45%.Through the results, it was found that the bi-interaction between the nano-organic fertilizer and the organic fertilizer was significantly excelled, as it gave the highest value for the percentage of total acidity in the berries juice at the level of 3 x 30 ml L^{-1}, which amounted to 0.79%.Compared to the no-adding treatment, which gave the lowest value of 0.39%. As for the bi-interaction between the biofertilizer and the organic fertilizer, it showed a significantly excelled by giving it the highest value of the percentage of total acidity in the juice of the berries at the level of 30 x 10 ml L^{-1}, amounting to 0.84%. Compared to the no-adding treatment, which gave the lowest value of 0.31%, it appeared through the results that the bi-interaction between the bio-fertilizer and the nano-organic fertilizer was significantly excelled as it gave the highest value for the percentage of total acidity in the juice of the berries at the level of 10 x 3 ml L^{-1} amounted to 0.83% compared to the treatment of Excluding the addition that gave the lowest value of 0.33%.The results of the table below indicated that there was a significantly excelled in the case of the triple interaction between biofertilizer, nano-organic fertilizer and organic fertilizer, which gave the highest value of the percentage of total acidity in the juice of berries at the level of 100 x 3 x 3 ml L^{-1} amounted to 0.95% compared to control treatment that gave the lowest value of 0.23%.

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Table (6) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in the percentage of total acidity in berry juice % for the first season2020

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	0		
		0.55	0.23	0	0
		0.71	0.34	1	
		0.76	0.42	3	
		0.59	0.31	0	15
		0.79	0.46	1	
		0.82	0.48	3	
		0.66	0.38	0	30
		0.88	0.52	1	
		0.95	0.63	3	
=0.005organic fertilizerL.S.D. =0.005nano organic fertilizerL.S.D. =0.005bio fertilizerL.S.D.		0.74	0.42	bio fertilizer average	
=0.014organic fertilizer × nano organic fertilizer bio fertilizer = L.S.D					

Average organic fertilizer	nano organic fertilizer			organic fertilizer
	3	1	0	
0.45	0.52	0.45	0.39	0
0.61	0.70	0.62	0.52	15
0.68	0.79	0.65	0.59	30
	0.67	0.57	0.50	Nano organic fertilizer average

=0.010organic fertilizer × nano organic fertilizer= L.S.D

	bio fertilizer		organic fertilizer
	10	0	
	0.60	0.31	0
	0.79	0.44	15
	0.84	0.51	30
	0.74	0.42	bio fertilizer average

=0.008organic fertilizer × bio fertilizer = L.S.D

	bio fertilizer		nano organic fertilizer
	10	0	
	0.67	0.33	0
	0.73	0.42	1
	0.83	0.51	3
	0.74	0.42	bio fertilizer average

=0.008nano organic fertilizer × bio fertilizer = L.S.D

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The results in table (7) indicated that there was a significantly excelled when adding biofertilizer, where it gave the highest value for the percentage of total acidity in the juice of berries at the level of 10 ml L^{-1} amounted to 0.99%, compared to the treatment of no addition, which gave the lowest value of 0.73%. In the case of spraying with nano-organic fertilizer, it gave the highest percentage value of total acidity in berry juice at a concentration of 3 ml / liter, which was 0.87%.Compared to the no-spray treatment, which gave the lowest value of 0.78%. When adding organic fertilizer, it gave the highest value for the percentage of total acidity in the juice of the berries at the level of 30 ml L^{-1} amounted to 0.92%, compared to the treatment of no addition, which gave the lowest value of 0.74%. As for the effect of the bi- interaction between the nano-organic fertilizer and the organic fertilizer, it gave the highest value for the percentage of total acidity in the berry juice at the level of 30 x 3 ml L^{-1}, which amounted to 1.02%, compared to the no-adding treatment, which gave the lowest value of 0.69%. Biofertilizers and organic fertilizers gave the highest percentage value of total acidity in berry juice at the level of 10 x 30 ml L^{-1}, which was 1.06%.Compared to the no-adding treatment, which gave the lowest value of 0.63%, the results showed that the bi-interaction between the bio-fertilizer and the nano-organic fertilizer gave the highest value for the percentage of total acidity in the juice of berries at the level of 1 x 10 ml L^{-1} amounted to 0.96%, compared to the no-adding treatment, which gave the lowest value. amounted to 0.66%.The results in Table (6) indicated that the triple interaction between bio-fertilizer, nano-organic fertilizer and organic fertilizer was significantly excelled by giving it the highest value for the percentage of total acidity in berry juice at the level of 10 x 3 x 30 ml L^{-1}, which amounted to 1.17%, compared to the control treatment, which gave the lowest value of 0.59%.

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Table (7) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in the percentage of total acidity in berry juice % for the second season2021

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	0		
		0.80	0.59	0	0
		0.94	0.68	1	
		0.97	0.72	3	
		0.85	0.63	0	15
		1.00	0.76	1	
		1.05	0.78	3	
		0.91	0.69	0	30
		0.79	0.83	1	
		1.17	0.87	3	
=0.091organic fertilizerL.S.D. =0.091nano organic fertilizerL.S.D. = 0.079 bio fertilizerL.S.D.		0.99	0.73	bio fertilizer average	
=0.225organic fertilizer × nano organic fertilizer bio fertilizer = L.S.D					

Average organic fertilizer	nano organic fertilizer			organic fertilizer
	3	1	0	
0.74	0.80	0.74	0.69	0
0.83	0.81	0.88	0.81	15
0.92	1.02	0.91	0.84	30
	0.87	0.84	0.78	Nano organic fertilizer average

=0.158organic fertilizer × nano organic fertilizer= L.S.D

	bio fertilizer		organic fertilizer
	10	0	
	0.85	0.63	0
	0.91	0.76	15
	1.06	0.79	30
	0.99	0.73	bio fertilizer average

=0.132organic fertilizer × bio fertilizer = L.S.D

	bio fertilizer		nano organic fertilizer
	10	0	
	0.90	0.66	0
	0.96	0.72	1
	0.95	0.80	3
	0.99	0.73	bio fertilizer average

=0.132nano organic fertilizer × bio fertilizer = L.S.D

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Percentage of total soluble solids/total acidity (T.S.S/T.A).

It was observed in Table (8) that the biofertilizer gave the highest value for the percentage of total soluble solids/total acidity at the level of 10 ml L^{-1} amounted to 32.5%, compared to the no-adding treatment, which gave the lowest value of 29.2%.It was clear from the results that the treatment of spraying with organic nano-fertilizers gave the highest value for the percentage of total soluble solids/total acidity at a concentration of 3 ml L^{-1} amounted to 31.8%, compared to the treatment of no spraying, which gave a value of 30.7%. The results showed that the addition of organic fertilizer gave the highest value for the percentage of total soluble solids/total acidity at the level of 30 ml L-1 amounted to 31.6%, compared to the treatment of no addition, which gave the lowest value of 29.3%.It was found through the results that the bi-interaction between the nano-organic fertilizer and the organic fertilizer gave the highest value for the percentage of total soluble solids/total acidity at the level of 1 x 0 ml L^{-1} amounted to 33.9%, compared to the non-adding treatment, which gave a value of 27.8%.As for the bi- interaction between the bio-fertilizer and the organic fertilizer, it showed a significantly excelled by giving it the highest value for the percentage of total soluble solids/total acidity at the level of 30 x 10 ml L^{-1}, which amounted to 37.6%, compared to the non-adding treatment, which gave a value of 29.5%.The results showed that the bi-interaction between bio-fertilizer and nano-organic fertilizer was significantly excelled, as it gave the highest value for the percentage of total soluble solids/total acidity at the level of 0 x 10 ml L^{-1} amounted to 32.0%, compared to the non-adding treatment, which gave the lowest value of 27.3%.The results of the table below indicated that there was a significantly excelled in the case of the triple interaction between bio-fertilizer, nano-organic fertilizer and organic fertilizer, as it gave the highest value for the percentage of total soluble solids/total acidity at the level of 100 x 3 x 3 ml L^{-1} amounting to 40.4% compared to the control treatment that gave a value It reached 26.0%.

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Table (8) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in the percentage of total acidity in berry juice % for the first season2020

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	0		
		29.6	26.0	0	0
		31.8	26.5	1	
		25.9	36.1	3	
		33.7	34.1	0	15
		28.9	26.5	1	
		29.6	37.2	3	
		39.1	21.8	0	30
		33.2	33.3	1	
		40.4	21.6	3	
=8.23organic fertilizerL.S.D. =8.23nano organic fertilizerL.S.D. =6.72bio fertilizerL.S.D.		32.5	29.2	bio fertilizer average	
=20.17 nano organic fertilizer and bio fertilizer = L.S.D					
Average organic fertilizer		nano organic fertilizer			organic fertilizer
		3	1	0	
30.7		30.4	33.9	27.8	0
30.0		33.2	27.7	29.1	15
31.8		31.0	33.4	31.0	30
		31.6	31.5	29.3	Nano organic fertilizer average
=14.26organic fertilizer × nano organic fertilizer= L.S.D					
		bio fertilizer		organic fertilizer	
		10	0		
		29.1	29.5	0	
		30.7	32.6	15	
		37.6	25.6	30	
		32.5	29.2	bio fertilizer average	
=11.64organic fertilizer × bio fertilizer = L.S.D					
		bio fertilizer		nano organic fertilizer	
		10	0		
		34.1	27.3	0	
		31.3	28.7	1	
		32.0	31.6	3	
		32.5	29.2	bio fertilizer average	
=11.64nano organic fertilizer × bio fertilizer = L.S.D					

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The results in Table (9) for the second season showed that the biofertilizer gave the highest value of the percentage of total soluble solids/total acidity at the level of 10 ml L^{-1}, amounting to 27.6%, compared to the no-adding treatment, which gave the lowest value of 27.1%. It was clear from the results that the treatment of spraying with organic nano-fertilizers gave the highest value for the percentage of total soluble solids/total acidity at a concentration of 3 ml L^{-1} amounted to 27.8%, compared to the treatment of no spraying, which gave a value of 27.3%.The results showed that the addition of organic fertilizer gave the highest value for the percentage of total soluble solids/total acidity at the level of 15 ml L^{-1}, which amounted to 29.0%, compared to the treatment of no addition, which gave a value of 26.9%.It was clear from the results that the bi-interaction between the nano-organic fertilizer and the organic fertilizer gave the highest value for the percentage of total soluble solids/total acidity at the level of 0 x 15 ml L^{-1} amounted to 31.7%, compared to the non-addiing treatment, which gave a value of 24.7%. The bi-interaction between organic fertilizer and organic fertilizer was significantly excelled by giving it the highest value for the percentage of total soluble solids/total acidity at the level of 0 x 15 ml L^{-1} amounted to 30.3% compared to the no-adding treatment, which gave a value of 27.9%. The results indicated that the bi-interaction between the bio-fertilizer Nano organic fertilizer significantly excelled as it gave the highest value for the percentage of total soluble solids/total acidity at the level of 0 x 3 ml L^{-1} amounted to 29.2% compared to the no-adding treatment which gave the lowest value of 25.5%.The results of the table below indicated that there was a significantly excelled in the case of the triple interaction between bio-fertilizer, nano-organic fertilizer and organic fertilizer, which gave the highest value for the percentage of total soluble solids/total acidity at the level 0 x 3 x 15 ml L^{-1} amounting to 34.2% compared to the control treatment that gave a value It reached 24.4%.

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Table (9) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer on and the interaction between them in the percentage of total acidity in berry juice % for the second season2021

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	0		
		25.0	24.4	0	0
		29.6	25.0	1	
		23.2	34.2	3	
		31.2	32.2	0	15
		23.8	24.4	1	
		28.0	34.2	3	
		30.8	19.9	0	30
		29.3	30.4	1	
		27.8	19.3	3	
=6.82organic fertilizerL.S.D. =6.82nano organic fertilizerL.S.D. =5.57bio fertilizerL.S.D.		27.6	27.1	bio fertilizer average	
=16.71organic fertilizer × nano organic fertilizer × bio fertilizer = L.S.D					
Average organic fertilizer		nano organic fertilizer			organic fertilizer
		3	1	0	
26.9		25.4	31.7	24.7	0
29.0		29.9	24.1	27.3	15
26.3		23.5	31.1	28.7	30
		27.8	27.1	27.3	Nano organic fertilizer average
=11.82organic fertilizer × nano organic fertilizer= L.S.D					
		bio fertilizer		organic fertilizer	
		10	0		
		26.0	27.9	0	
		27.7	30.3	15	
		29.3	23.2	30	
		27.6	27.1	bio fertilizer average	
=9.65organic fertilizer × bio fertilizer = L.S.D					
		bio fertilizer		nano organic fertilizer	
		10	0		
		29.0	25.5	0	
		27.6	26.6	1	
		26.3	29.2	3	
				bio fertilizer average	
=9.65nano organic fertilizer × bio fertilizer = L.S.D					

Percentage of reducing sugars in berry juice (%)

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The results in Table (10) showed that the biofertilizer was significantly excelled by giving it the highest value at the level of 10 ml L^{-1} for the percentage of reducing sugars in the berry juice amounted to 8.02%Compared to the treatment of no addition, which gave the lowest value of 6.32%, while the results showed that the treatment of spraying with nano-organic fertilizer significantly excelled by giving it the highest value at a concentration of 3 ml L^{-1} for the percentage of reducing sugars in the juice of the berries amounted to 7.16%.Compared to the no-spray treatment, which gave the lowest value of 6.78%. The results indicated that there was a significantly excelled when adding organic fertilizer, which gave the highest value at level 30 ml L-1 for the percentage of reducing sugars in the berry juice amounted to 7.66%, compared to the no-adding treatment, which gave less value of 6.52%.In the case of the bi-interaction between the nano-organic fertilizer and the organic fertilizer, it gave the highest value at the level of 30 x 3 ml L-1 for the percentage of reducing sugars in the berries juice amounted to 8.15%, compared to the non-adding treatment, which gave the lowest value of 6.18%As for the bi-interaction between bio-fertilizer and organic fertilizer, it was significantly excelled by giving it the highest value at the level of 30 x 10 ml L^{-1} for the percentage of reducing sugars in the berry juice amounted to 8.55%, compared to the no-adding treatment, which gave the lowest value of 5.80%.The results showed that the bi-interaction between the bio-fertilizer and the nano-organic fertilizer gave a value at the level of 10 x 3 ml L^{-1} for the percentage of reducing sugars in the berry juice amounted to 8.44%, compared to the control treatment that gave the least value 5.90.The results of table (9) showed that there was a significantly excelled in the case of the triple interaction between biofertilizer, nano-organic fertilizer and organic fertilizer, which gave the highest value at the level of 10 x 3 x 30 ml L^{-1} for the percentage of reducing sugars in berry juice amounted to 8.93% compared to the control treatment that gave the lowest value amounted to 5.42%.

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Table (10) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in the percentage of reducing sugars in berry juice % for the first season2020

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	0		
		6.93	5.42	0	0
		7.89	5.93	1	
		8.14	6.34	3	
		7.12	5.84	0	15
		8.21	6.44	1	
		8.57	6.59	3	
		7.68	6.16	0	30
		8.72	6.81	1	
		8.93	7.38	3	
= 0.064organic fertilizerL.S.D. =064nano organic fertilizerL.S.D. = 0.055bio fertilizerL.S.D.		8.02	6.32	bio fertilizer average	
= 0.157organic fertilizer × nano organic fertilizer× bio fertilizer = L.S.D					
Average organic fertilizer		nano organic fertilizer			organic fertilizer
		3	1	0	
6.52		6.92	6.48	6.18	0
7.33		7.76	7.33	6.91	15
7.66		8.15	7.58	7.24	30
		7.16	7.13	6.78	Nano organic fertilizer average
= 0.110organic fertilizer × nano organic fertilizer= L.S.D					
		bio fertilizer		organic fertilizer	
		10	0		
		7.24	5.80	0	
		8.28	6.39	15	
		8.55	6.77	30	
		8.02	6.32	bio fertilizer average	
=0.092organic fertilizer × bio fertilizer = L.S.D					
		bio fertilizer		nano organic fertilizer	
		10	0		
		7.65	5.90	0	
		7.97	6.29	1	
		8.44	6.78	3	
		8.02	6.32	bio fertilizer average	
=0.092nano organic fertilizer × bio fertilizer = L.S.D					

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It appeared through the results of Table (11) for the second season that the addition of biofertilizer gave the highest value at the level of 10 ml L^{-1} for the percentage of reducing sugars in the berry juice amounted to 7.24%, compared to the treatment of no addition, which gave the lowest value of 7.14%. This was observed through the results The treatment of spraying with nano-organic fertilizer was excelled by giving it the highest value at a concentration of 3 ml L^{-1} for the percentage of reducing sugars in the berry juice amounted to 7.42%, compared to the treatment of no spraying, which gave the lowest value of 6.94%. Through the results, it appeared that there was a significant superiority when adding organic fertilizer Which gave the highest value at the level of 30 ml L^{-1} for the percentage of reducing sugars in the juice of berries 7.61%, compared to the no-adding treatment, which gave the lowest value of 6.94%. As for the bi-interaction between nano-organic fertilizer and organic fertilizer, it was significantly superior as it gave the highest value at the level of 30 x 3 ml L^{-1} for the percentage of reducing sugars in berry juice amounted to 8.09%, compared to the no-additive treatment, which gave the lowest value of 5.75%. In the case of the bi-interaction between the biofertilizer and the organic fertilizer, it gave the highest value at the level of 0 x 30 ml L^{-1} for the percentage of reducing sugars in the berry juice amounted to 7.85%, compared to the no-adding treatment, which gave the lowest value of 6.60%. The results showed that the bi-interaction between the biofertilizer and the fertilizer The nano organic was excelled as it gave the highest value at thelevel of 0 x 3 ml L^{-1} for the percentage of reducing sugars in the juice of the berries amounted to7.47%, compared to the treatment of no addition, which gave the lowest value of 6.80%.While it was found that the triple interaction between bio-fertilizer, nano-organic fertilizer and organic fertilizer was significantly superior as it gave the highest value at the level 0 x 3 x 30 ml L^{-1} for the percentage of reducing sugars in the berry juice amounted to 8.55% compared to the control treatment that gave the lowest value of 4.99%.

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Table (11) Effect of addition of biofertilizer , liquid organic fertilizer and foliar spraying of nano-liquid organic fertilizer and the interaction between them in the percentage of reducing sugars in berry juice% for the second season2021

		bio fertilizer		nano organic fertilizer ml.L-1	organic fertilizer ml.L-1
		10	0		
		6.51	4.99	0	0
		7.66	7.23	1	
		7.64	7.58	3	
		7.99	7.26	0	15
		6.48	7.42	1	
		6.81	6.28	3	
		6.77	8.15	0	30
		7.69	6.85	1	
		7.64	8.55	3	
=0.645organic fertilizerL.S.D. =0.645nano organic fertilizerL.S.D. =0.527bio fertilizerL.S.D.		7.24	7.14	bio fertilizer average	
=1.580organic fertilizer × nano organic fertilizer bio fertilizer = L.S.D					
Average organic fertilizer		nano organic fertilizer			organic fertilizer
		3	1	0	
6.94		7.46	7.62	5.75	0
7.04		7.27	6.95	7.44	15
7.61		8.09	6.55	7.61	30
		7.42	7.22	6.94	Nano organic fertilizer average
=1.117organic fertilizer × nano organic fertilizer= L.S.D					
		bio fertilizer		organic fertilizer	
		10	0		
		7.27	6.60	0	
		7.09	6.99	15	
		7.37	7.85	30	
		7.24	7.14	bio fertilizer average	
=0.912organic fertilizer × bio fertilizer = L.S.D					
		bio fertilizer		nano organic fertilizer	
		10	0		
		7.09	6.80	0	
		7.28	7.16	1	
		7.37	7.47	3	
		7.24	7.14	bio fertilizer average	
=0.912nano organic fertilizer × bio fertilizer = L.S.D					

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Discussion

The reason for the increase in the level of phosphor in the leaves can be explained by the fact that the treatment of plants with organic fertilizer leads to an improvement in the nutritional status of the plant, as it provides macro and microelements in large quantities, which may positively affect the traits of vegetative growth[4]. Or due to the role of nano-organic fertilizer in the formation of a strong root and vegetative complex, which may affect the increase in the efficiency of the absorption of other nutrients by the roots and then increase their concentration inside the plant, in addition to the fact that the high entry of nutrients particles in the nano-fertilizer requires the withdrawal of the necessary nutrients in order for the process of photosynthesis to take place.[20].The reason for the increase in the content of nutrients in the leaves may also be attributed to the direct absorption of these elements in the organic fertilizer, which led to an increase in their concentration. Element (P), the reason for the increase in the quantitative traits of the crop present when treated with nano-organic fertilizer may be due to the improvement of the nutritional status of the plant, which led to an increase in leaf area, the number of leaves, and the content of the leaf of chlorophyll and nutrients, which led to an increase in the quantitative traits mentioned above and are in line with The results are in line with the findings of [6].that there was a significant increase in the vegetative indicators and quantitative traits of the yield when grape vines were treated with organic fertilizer.And it agrees with [7].in the study of the response of the strawberry plant to the treatment with the organic solution, which caused a significant increase in the quantitative traits represented by (the number of fruits, the weight of the fruits, the yield of one plant, and is also consistent with what was reached by [25]. that there was an increase in productivity. When treated with organic fertilizers, these fertilizers meet the plant's needs for nutrients. With regard to the effect of adding organic fertilizers on the chemical and qualitative traits represented by (total acidity percentage, total sugars percentage), the reason for the decrease in the total acidity percentage when treated with organic fertilizers may be attributed to the increase in the total sugars percentage. The results are consistent with what was reached by [21]. when adding organic matter to silica led to a decrease in the total acidity in the fruits and with [18].when treating olive trees with humic fertilizer caused a decrease in the percentage of total acidity in the fruits [16] and [28].when treating grapes with a dilute humic solution caused a decrease in the percentage of total acidity, either the reason for the increase in the percentage of total sugars may be due to the increase in leaf area, the number of leaves, the content of leaves of chlorophyll, and the content of fruits of anthocyanin pigment(result not publish here). Or it may be due to the fact that the organic fertilizer provides the plant with nutrients, including nitrogen,phosphor, potassium as it increases the efficiency of the processes, which may be reflected positively in the increase in total sugars, and the results are consistent with [9] and [31].

Conclusions:

1- Fertilization had a positive effect on improving the chemical traits due to what it achieved in increasing the content of nutrients(phosphor) .

2- The process of spraying with bio-fertilizer had a positive effect on improving the traits of vegetative growth and also led to an increase in the coloration of the berry s through increasing the concentration of the anthocyanin dye in the berry s because it contains organic carbon and nitrogen.

3- A The interactions between fertilizers showed a positive effect on most of the studied indicators.

4- The triple interaction between organic fertilizer, bio-organic and nano-organic

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fertilizer resulted in a significant increase in most of the studied traits.

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