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Effect of spraying cytokinin, populist extract and copper sulfate on some vegetative growth traits of fig-trees, Aswood Diyala cultivar (*Ficus carica* L.)

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***Abstract*---**This study was conducted in one of the private orchards in Babylon province for the season 2020 - in which 54 fig trees of homogeneous size and growth strength were selected and planted at distances (5 x 5 m).: The experiment is implemented by (R.C.B.D) and with three replicates of cytokinin were (0, 100, 200 $Mg.L^{-1}$) and populists extract (0, 10, 20) g. L^{-1}, and CuSo4 (0, 2) g. L^{-1}.Storage experiment: It included the selection of a quantity of fruits at the beginning of maturity and the healthy fruits were selected from them and were placed in polyethylene bags perforated with 12 holes with a diameter of 5 mm at a rate of 1 kg of fruits in each bag for each treatment and then stored at a temperature of 5 ° C and relative humidity of 85 - 80% for 8 days After the storage period, the traits were measured. The results were analyzed using the same design method in the field experiment. The use of the study factors led to good results in the traits of the stored fruits after 8 days of storage Where the use of the study factors led to a reduction in the total spoilage of fruits, weight loss, and respiration rate, and total soluble solids (3.19% – 4.12% - 8.82 $mg.co_2/h$ 14.08 %), respectively, compared to the highest percentage of these traits and amounted to (6.37 % – 10.58 % - 10,05. $mg.co_2/h$ 16.96 %)Regarding the characteristics of the fruit hardness, it was significantly affected by the spraying of cytokinin, extract and CuSo4.The highest results of fruit hardness and vitamin C were obtained when using the of the combined factors (200 Mg.L-1 of cytokinin, 20 g/L of populist extract, and 2 g/L of CuSo4), and the highest rates were for these two traits (0.34k.g/cm – 6.96 %) and the lowest averages (0.28 k.g/cm 6.02%) when control treatment.

***Keywords*---**spraying cytokinin, *Ficus carica L.*, populist extract and copper sulfate.

Introduction

The fig (*Ficus carica* L.) is a deciduous fruit tree belonging to the Moraceae family, It is believed that its original country is the south of the Arabian Peninsula, and there are still wild forests from it (1). The Aswood Diyala fig cultivar is one of the local cultivars widely spread in the central region of Iraq, which farmers prefer to grow over the rest of the cultivars due to its abundant production and desirable taste for consumers, in addition to the medium size of the tree and the large and dense leaf area that protects the fruits from sunstroke in the summer months (2)The cytokinins have different functions within the plant. They work to increase the expansion and division of cells and increase the thickness of the cell wall, which helps reduce total loss and spoilage as well as its role in reducing ethylene. The Aswood Diyala fig cultivar is one of the local cultivars widely spread in the central region of Iraq, which farmers prefer to grow over the rest of the cultivars due to its abundant production and desirable taste for consumers, in addition to the medium size of the tree and the large and dense leaf area that protects the fruits from sunstroke in the summer months (3), The cytokinins have different functions within the plant. They work to increase the expansion and division of cells and increase the thickness of the cell wall, which helps reduce total loss and spoilage as well as its role in reducing ethylene. The Euphrates poplar plant contains a high percentage of salicin, which has an important role in stimulating the growth of plants and inhibiting the growth of bacteria and fungi that infect them and that the newly opened buds contain three times more phenolic compounds that inhibit the growth of microorganisms and (4) indicated that the salicin compound works to protect plants from some biological diseases caused by fungi and bacteria and improve their growth.Copper sulfate is also used as anti-bacterial and anti-fungal, as well as its role as nutritional element.

Materials and Methods

The study included 18 treatments and each treatment was repeated three times (each unit tree was considered experimental), the experiment was implemented as a factorial experiment and the Randomized Complete Block Design (R.C.B.D) was chosen with three factors and three replicates (3 x 3 x 2).The replicate is one tree, where the levels of cytokinin (0, 100, 200) $Mg.L^{-1}$ iter, populist extract (0, 10, 20) g . L^{-1}, and copper sulfate (0, 2) g . L^{-1} spraying on the vegetative in three periods. Then the results were analyzed according to the analysis of the variance table and the averages were compared using the L.S.D test at a probability level of 5% (5) The experiment was conducted in three sprays, the first on 3/24/ and the second on 04/24/ and the third on 5/24/2020, where the trees were sprayed until completely wetness, and dishwashing liquid was added as a diffuser The following traits were measured:

The following traits were measured:

1- Average leaf area
2- The carbohydrate content of the leaves

3- Leaf content of chlorophyll
4- The average branches length

The treatments were as follows:-
. The comparison was sprayed with distilled water
Copper sulfate 2 g/L + 0 Populist extract + 0 Paisen .
. Copper sulfate 0 + g / L10 populists extract + 0 Paisen
. Copper sulfate 2 g/L + 10 g/L Populist extract + 0 Paisen
. Copper sulfate 0 + g /L 20 populist extract + 0 Paisen
+ Copper sulfate 2 g / L. 20 g/L Western Blossom Extract + 0 Paisen
Copper sulfate 0. + 0 Western Blossom Extract + mg/L 100 Paisen
. Copper sulfate 2 g/L + 0 populist extract + mg/L 100 Paisen
. Copper sulfate 0 + g / L 10 populist extract + mg / l 100 Paisen
. Copper sulfate 2 g/L + 10 g/L Populist extract + mg/L 100 Paisen
. Copper sulfate 0 + g / L 20 populist extract + mg / L 100 Paisen
. Copper sulfate 2 g/L + 20 g/L Populist extract + mg/L 100 Paisen
Copper sulphate 0+0 Populist extract+ mg/L 200 Paisen .
. Copper sulfate 2 g/L + 0 Populist extract + mg/L 200 Paisen
. Copper sulfate 0 + g / L 10 populist extract + mg / L 200 Paisen
. Copper sulfate 2 g/L + 10 g/L Populist extract + mg/L 200 Paisen
Copper sulfate 0 + g/L 20 populist extract + mg/l 200 Paisen
. Copper sulfate 2 g/L + 20 g/L Populist extract + mg/L 200 Paisen

Results and Discussion

1- Average leaf area(cm^2)
The data in Table (1), we find that the treatment of trees with cytokinin led to a significant increase in the average leaf area, which recorded the highest average when using the concentration 200 mg, and it reached 163.80 cm^2 Compared with the lowest average in the control treatment, which was 151.44 cm^2, spraying populist extract also led to a significantly excelled in this trait. As for the lowest average leaf area when compared, it was (155.38 cm^2). Copper sulfate spraying also led to a significant increase in the average leaf area and the use of concentration 2 gave an average of 152.00 cm, compared to the lowest average of control treatment, which amounted to (158.06 cm^2). We also see from the results of the table that the triple interaction has a clear effect on the average leaf area .The use of the concentration of 200 mg / L of cytokinin, 20 g / L of extract and 2 g / L of copper sulfate gave the highest average for leaf area and was -168.89 cm^2 measured by the lowest average when the control treatment was recorded -150.01

2- Average branches length (cm)
The proven results in Table (2) indicate that the spraying of cytokinin had a significant effect on the average length of branches, and the highest average of branch length when spraying the concentration 200 mg / L was 15.47 cm .Compared to the lowest rates recorded when the control treatment was 12.51cm. With regard to populist extract, it did not significantly affect the average length of branches, as the treatment 10 g / L was excelled by giving it the highest average of 14.20 cm Compared to the lowest average length of branches, which recorded 12.79 cm when compared. Also, the use of copper sulfate had a significant effect on this trait, and the highest rate was 12.20 -13.28 cm Compared to the lowest

average branches length, which recorded 11.36 cm when compared. The triple interaction between the factors also had a significant effect, and the highest average branch length at the highest concentrations was 16.02 cm. Compared to the lowest rate when the control treatment was 10.75cm when compared.

Table (1) Effect of spraying cytokines of populist extract and copper sulfate on average leaf area cm^2

			Treatments	
interaction A*B	C		B	A
	C_2	C_1		
150.56	151.11	150.01	B_1	A_1
151.72	151.93	151.52	B_2	
151.96	152.43	151.49	B_3	
153.64	154.55	152.74	B_1	A_2
158.46	159.40	157.51	B_2	
160.02	158.70	161.34	B_3	
161.92	162.56	161.29	B_1	A_3
162.45	162.97	161.93	B_2	
167.02	168.89	165.16	B_3	
2.897	4.097		LSD	
A effect	158.06	152.00	C effect	
	1.366		LSD	
151.41	151.82	151.00	A_1	interaction A*C
157.37	157.55	157.20	A_2	
163.80	164.81	162.79	A_3	
1.672	2.365		LSD	
B effect				
155.38	156.07	154.68	B_1	interaction B*C
157.54	158.10	156.99	B_2	
159.67	160.01	159.33	B_3	
1.672	2.365		LSD	

Table (2) Effect of spraying cytokines of populist extract and copper sulfate on the average length of branches/cm

			Treatments	
interaction A*B	C		B	A
	C_2	C_1		
11.63	12.51	10.75	B_1	A_1
12.57	12.66	12.49	B_2	
13.32	13.62	13.02	B_3	
13.21	13.63	12.80	B_1	A_2
13.73	13.78	13.69	B_2	
14.24	14.49	14.00	B_3	
14.27	14.61	13.93	B_1	A_3

15.65	16.02	15.28	B_2	
15.99	15.10	14.89	B_3	
1.043	1.474		LSD	
A effect	12.20	11.36	C effect	
	0.491		LSD	
12.51	12.93	12.09	A_1	interaction A*C
13.76	13.75	13.77	A_2	
15.47	15.92	15.03	A_3	
0.602	0.851		LSD	
B effect				
12.79	13.81	11.77	B_1	interaction B*C
14.10	14.18	14.02	B_2	
14.20	14.30	14.10	B_3	
0.602	0.851		LSD	

3-Leaves content of total chlorophyll

We note from the data in Table (3) that treating trees with different concentrations of cytokinin led to a significant increase in the total chlorophyll content of leaves, and the highest total chlorophyll content was when using the concentration 200 mg/L, reaching 115.20 g/kg dry weight compared to the lowest content of chlorophyll at The comparison treatment amounted to 111.77 g / kg dry weight. Also, the use of the extract had a significant effect on the chlorophyll content of the leaves, and the highest rates were recorded at the concentration of 20 g / L and it reached 114.12 g/kg dry weight. The lowest rate of total chlorophyll was recorded in the comparison treatment, which is 112.71 g/kg dry weight and copper sulfate had a significant effect on this trait, and the highest rate was recorded when spraying 2 g/L 113.90 - 114.56 g/kg dry weight compared to the lowest content - 113.27 g/kg dry weight when compared. Also, the triple interaction was significant in the total chlorophyll content of the leaves, and it was when using the highest concentration of the studied factors, which gave 115.69 - while the lowest content was 110.56 g/kg dry weight.

4- Leaves content of total carbohydrates

It is concluded from the results in Table (4) that the spraying of cytokinin had a significant effect on the percentage of total carbohydrates in the leaves, and the highest percentage recorded when using the concentration 200 mg/L was 17.86% Compared to the lowest percentage of carbohydrates, which is 13.51 % when compared. Also, the use of the extract had a clear and significant effect, and the highest carbohydrate content of the leaves was recorded at the concentration of 20 g/L, and it was 16.60 %, while the lowest content was 14.96 % in the comparison treatment. Copper sulfate significantly affected the total carbohydrate content of the leaves, and the highest content was recorded when spraying 2 g/L, and it amounted to - 16.09%, and the lowest rate was when compared, which amounted to 11.46 % and the triple interaction affected significantly this trait, and the highest concentrations of all factors recorded the highest results and amounted to - 18.14 %, compared to the lowest carbohydrate content, it was 10.85 % when compared.

Table (3) Effect of spraying cytokinin, populist extract and copper sulfate on the total leaf content of total chlorophyll g/kg dry weight

			Treatments	
interaction A*B	C		B	A
	C_2	C_1		
110.94	111.33	110.56	B_1	A_1
111.85	112.49	111.22	B_2	
112.52	112.60	112.44	B_3	
112.63	112.81	112.44	B_1	A_2
113.42	113.63	113.22	B_2	
114.33	114.77	113.88	B_3	
114.56	114.73	114.39	B_1	A_3
115.14	115.16	115.13	B_2	
115.52	115.69	115.34	B_3	
0.889	1.258		LSD	
A effect	113.90	113.27	C effect	
	0.419		LSD	
111.77	112.00	111.55	A_1	interaction A*C
113.46	113.74	113.18	A_2	
115.20	115.17	115.07	A_3	
0.514	0.726		LSD	
B effect				
112.71	112.84	112.58	B_1	interaction B*C
113.47	113.67	113.28	B_2	
114.12	114.30	113.94	B_3	
0.514	0.726		LSD	

Table (4) Effect of spraying cytokinin, populist extract and copper sulfate on the carbohydrate content of leaves %

			treatments	
interaction A*B	C		B	A
	C_2	C_1		
12.02	13.18	10.85	B_1	A_1
13.69	13.80	13.58	B_2	
14.81	15.32	14.30	B_3	
15.13	15.26	15.00	B_1	A_2
15.83	16.55	15.12	B_2	
16.88	17.10	16.66	B_3	
17.73	17.92	17.55	B_1	A_3
17.74	17.92	17.57	B_2	
18.12	18.14	18.10	B_3	
1.125	1.591		LSD	
A effect	16.09	11.46	C effect	
	0.530		LSD	
13.51	14.10	12.91	A_1	interaction A*C
15.95	16.30	15.59	A_2	

17.86	17.87	17.86	A_3	
0.649	0.919		LSD	
B effect				
14.96	15.33	14.59	B_1	interaction B*C
15.75	16.09	15.42	B_2	
16.60	16.85	16.35	B_3	
0.649	0.919		LSD	

The reason for the increase in the rates of length, number of branches, leaf area and total chlorophyll may be due to the role of cytokinin in the withdrawal of nutrients, and this is reflected in the increase in these traits (6) As for the increase in spraying western sprouts extract, it is due to its role in increasing growth because it contains compounds related to an increase in total chlorophyll and plant hormones such as salicylic. Copper sulfate also has a role in the formation of enzymes that play in oxidative reactions and reduction in plants, as well as entering the synthesis of phenols and lactase, and is a necessary element in the formation of chlorophyll, and here it has an important role in increasing the photosynthesis process of trees, whose concentration increases in their vegetative growth (7).

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