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Effect of Adding Amino Acids and Liquid Organic Fertilizer on the Growth and Mineral Content of the Seedling of Sour Orange and Poncirus Trifoliata

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Abstract:

The large use of chemical fertilizers in fruit orchards often results in some problems, such as the loss of a large amount of the added nitrogen through the bioreduction of nitrates or through the leaching of the nitrogen element through ground water, ultimately causing environmental pollution and harm to human health, as well as Excessive use of chemical fertilizers, especially nitrogenous ones, leads to environmental pollution. As a result of all these bad effects of the irrational use of chemical fertilizers, the interests of many countries have recently turned towards searching for natural alternatives to chemical fertilizers with the aim of reducing environmental pollution and reducing agricultural production costs, and at the same time producing safe, healthy food.The study was carried out with the aim of demonstrating the effect of foliar spray with three concentrations of amino fertilizer (Delfan plus) (0, 3 and 6 $ml.L^{-1}$) and liquid organic fertilizer (compo) (0, 6 and 8 $ml.L^{-1}$) on the growth and mineral content of seedlings sour orange and Poncirus trifoliata, as fertilization was done in four batches starting from 3/20/2022, with 20 days between batches and the next. The results showed that the type of citrus (sour orange and Poncirus trifoliata) did not have a significant effect on the studied traits, while the fertilizer treatments for both Delfan plus and combo resulted in a significant superiority. especially the high concentrations of 6 and 8 ml. L^{-1}, respectively, Where it caused the highest values in all the characteristics studied (increase in the height and diameter of seedlings and the leaves content of chlorophyll, nitrogen, phosphorus, potassium, and protein).

Keywords: Amino acids. liquid organic. fertilizers. seedlings. mineral content.

1.Introduction:

There are many horticultural service operations that are offered for fruit seedlings in nurseries. The most important of these processes is the fertilization process, especially with organic fertilizers, which leads to accelerating growth and obtaining strong seedlings. (**Al-Araji et al., 2023**) ، Many studies have indicated the importance of foliar spray of fruit seedlings with organic fertilizers that contain amino acids because of their role in accelerating their growth, increasing the leaves' content of chlorophyll and nutrients, and increasing their leaf surface area (**Alalaf et al., 2022**) ، As amino acids are the building block of protein materials, they act as a vital stimulant that is absorbed and transported quickly within the various parts of the plant because of their direct impact on the enzymatic activity in the plant. They are involved in the synthesis of vitamins, enzymes and plant hormones and participate in enzymatic reactions in cells, in addition to their role in increasing absorption. Nutrients and opening stomata by raising the osmotic potential of the cytoplasm of guard cells. Foliar spraying with amino acids also has an important role in reducing the damage to stresses to which the plant is exposed, such as heat and salt stress, by reducing the osmotic potential and thus improving growth (**Abdel Hafez, 2006**). Many studies have also indicated that foliar spraying with liquid organic fertilizers has a positive effect in improving the growth characteristics of seedlings and accelerating their grafting, in addition to its importance in improving the characteristics of the soil and the readiness of nutrients and equalizing the degree of soil interaction when added to it, thus working to increase its fertility. In addition to its role in increasing the activity of microorganisms in the soil and increasing the soil's ability to retain water, especially light-textured sandy soil (**Alalaf et al., 2023**). The goal of this study is to accelerate the growth of citrus seedlings (sour orange and Poncirus trifoliata seedlings) through the use of organic fertilizers for the purpose of planting them in the orchard and reaching the fruiting stage.

2.Materialsandmethods:

The study was carried out during the 2023 growing season on one-year-old seedlings of sour orange and Poncirus trifoliata. almost uniform in growth, 40-50 cm high, with a main stem diameter of 3-4 mm, They were grown in 8 kg anvils containing riverine agricultural medium,the control seedlings were sprayed with distilled water, while the amino fertilizer (Delfan plus) was added, which contains (28.8% free amino acids, 10.8% total nitrogen, 6.0% organic nitrogen, 27.6% organic carbon, and 44.4% Organic matter) at levels (0, 3, and 6 $ml.l^{-1}$) and organic fertilizer (compo), which contains (52% organic matter, 3% organic nitrogen, and 6% K_2O) at concentration (0, 6, and 8 $ml.l^{-1}$) Spray on the shoots of seedlings until they are completely wet، Fertilization was done in four batches, starting on 20/3/2023, with 20 days between batches and the next. The study was carried out according to the design of (R.C.B.D.) with three replicates, and each experimental unit included 5 plants, bringing the total number of plants to 270. The Duncan multinomial test was used to compare means. The following characteristics were measured: (Leaf N , P , K and Protein concentration % ، Seedling height (cm) ، Seedling diameter (mm)، Leaf concentration of chlorophyll (SPAD).

3.Results: -

The results of Table (1) indicate that the two types of citrus used in the study had no effect on the height of seedlings, while concentrations of Delfan Plus fertilizer 3 and 6 ml.l^{-1}, as well as a concentration of 6 ml.l^{-1} of combo fertilizer, caused an increase in the values of this trait. As for the binary interactions, we find that the binary interaction is between sour orange and a concentration of 6 ml l^{-1} of Delfan Plus fertilizer, the interaction with a concentration of 8 ml l^{-1} of the combo fertilizer, and the interaction between a concentration of 3 ml l^{-1} of the amino fertilizer and a concentration of 8 ml l^{-1}. Of the organic fertilizer, it achieved the highest values for this characteristic, while for the triple interaction between the factors, we find that the highest value recorded was the result of the interaction between the sour orange type and a concentration of 3 ml l^{-1} of amino fertilizer and a concentration of 8 ml l^{-1} of organic fertilizer.

Table (1): The effect of fertilizer treatments and the interaction between them in the seedling height (cm) of sour orange and Poncirus trifoliata seedlings.

		Liquid Organic Fertilizer Concentrations				
Root stock citrus	Amino fertilizers Concentrations	Control	6 mll $^{1-}$	8 mll $^{1-}$	Average root stock	
sour orange	Control	51.50 B-C	56.29 A-C	59.51 A-C	sour orange	62.62 A
	3 ml.L $^{1-}$	59.46 A-C	60.83 A-C	72.00 A	poncirus trifoliata	61.19 A
	6 ml.L $^{1-}$	66.49 AB	65.83 AB	71.66 A	Average concentrations of amino fertilizer(Delfan plus)	
poncirus trifoliata	Control	43.44 C	58.44 A-C	58.95 A-C	54.69 B	
	3 ml.L $^{1-}$	60.44 A-C	62.01 A-C	74.22 A	64.82 A	
	6 ml.L $^{1-}$	66.11 AB	62.00 A-C	65.11 AB	66.20 A	
interaction between root stock and organic fertilizer	sour orange	59.15 AB	60.98 AB	67.72 A	interaction between root stock and the amino fertilizer	
	poncirus trifoliata	56.66 B	60.81 AB	66.09 AB	sour orange	poncirus trifoliata
interaction between amino fertilizer and organic fertilizer	Control	47.47 C	57.36 BC	59.23 BC	55.77 BC	53.61 C
	3 ml.L $^{1-}$	59.95 B	61.42 AB	73.11 A	64.09 AB	65.55 AB
	6 ml.L $^{1-}$	66.30 AB	63.91 AB	68.39 AB	67.99 A	64.40 AB
Average concentrations of organic (fertilizer(combo		57.91B	60.90AB	66.91A		

Coefficients with similar letters in the same column are not significantly different according to Duncan's multinomial test at the 5% probability level.

It is clear from the results shown in Table (2) that the type of citrus, as well as the values of the organic fertilizer Combo, did not significantly affect the values of the seedling diameter trait, while the Delfan Plus fertilizer treatment with 6 ml l^{-1} gave the highest value in the values of this trait, as for the binary interactions. We notice that the highest values for this characteristic were when the two types of citrus under study were interacted with a concentration of 6 ml l^{-1} of Delfan Plus fertilizer, as well as the interaction between 6 ml l^{-1} of the same fertilizer and a concentration of 8 ml l^{-1} of the Combo fertilizer, while it was not There are differences in the binary interaction between the two types of citrus and the organic fertilizer combo, and in the case of the triple interaction between the factors, we find that the highest value for this characteristic was in the interaction between 6 ml l^{-1} of the same fertilizer and a concentration of 8 ml l^{-1} of the combo fertilizer for the type Poncirus trifoliata.

Table (2): The effect of fertilizer treatments and the interaction between them in Increase in seedling diameter (mm) of sour orange and Poncirus trifoliata seedlings.

		Liquid Organic Fertilizer Concentrations				
Root stock citrus	Amino fertilizers Concentrations	Control	6 mlL $^{1-}$	8 mlL $^{1-}$	Average root stock	
sour orange	Control	1.29 CD	1.32 CD	1.32 CD	sour orange	1.59 A
	3 ml.L $^{1-}$	1.35 CD	1.63 A-D	1.50 B-D	poncirus trifoliata	1.67 A
	6 ml.L $^{1-}$	1.74 A-D	1.82 A-D	2.33 AB	Average concentrations of amino fertilizer(Delfan plus)	
poncirus trifoliata	Control	1.17 D	1.18 CD	1.22 CD	1.25 C	
	3 ml.L $^{1-}$	1.52 A-D	1.80 A-D	1.77 A-D	1.59 B	
	6 ml.L $^{1-}$	1.95 A-D	2.06 A-C	2.38 A	2.04 A	
interaction between root stock and organic fertilizer	sour orange	1.46 A	1.59 A	1.71 A	interaction between root stock and the amino fertilizer	
	poncirus trifoliata	1.55 A	1.68 A	1.79 A	sour orange	poncirus trifoliata
interaction between amino fertilizer and organic fertilizer	Control	1.23 D	1.25 D	1.27 CD	1.31 BC	1.19 C
	3 ml.L $^{1-}$	1.44 B-D	1.71 B-D	1.63 B-D	1.49 BC	1.70 AB
	6 ml.L $^{1-}$	1.84 A-C	1.94 AB	2.35 A	1.96 A	2.13A
Average concentrations of organic fertilizer(combo)		1.50A	1.63A	1.75A		

Coefficients with similar letters in the same column are not significantly different according to Duncan's multinomial test at the 5% probability level.

The type of citrus did not have any significant effect on the chlorophyll content of the leaves, as it was found that there were no significant differences between (sour orange and Poncirus trifoliata) (Table (3), while the concentrations of DelfanPlus fertilizer caused a significant increase in this trait, especially the concentration of 6 ml $^{-1}$. The concentration of the Combo fertilizer also had a positive effect on the values of this trait, especially when the concentration of 8 ml $^{-1}$ was added. As for the binary interactions, the highest values for this trait were in the interaction between the two types of citrus and the concentrations of Delfan Plus and Combo fertilizer, especially the concentration of 6 ml $^{-1}$. Of Delfan Plus and 8 ml $^{-1}$ of Combo. It is also noted that with regard to the three-way interaction between the study factors, the highest significant value for the trait was in the interaction between a concentration of 6 ml $^{-1}$of Delfan Plus and a concentration of 6 ml $^{-1}$of Combo for the species Poncirus trifoliata.

Table (3): The effect of fertilizer treatments and the interaction between them in Chlorophyll (SPAD) content of leaves of sour orange and Poncirus trifoliata seedlings.

		Liquid Organic Fertilizer Concentrations				
Root stock citrus	Amino fertilizers Concentrations	Control	6 mlL $^{1-}$	8 mlL $^{1-}$	Average root stock	
sour orange	Control	57.03 CD	63.56 A-C	60.09 B-D	sour orange	62.93 A
	3 ml.L $^{1-}$	59.85 B-D	63.92 A-C	68.46 A	poncirus trifoliata	64.10 A
	6 ml.L $^{1-}$	63.43 A-C	64.57 AB	65.50 AB	Average concentrations of amino fertilizer(Delfan plus)	
poncirus trifoliata	Control	55.24 D	60.36 B-D	62.51 A-C	59.80 B	
	3 ml.L $^{1-}$	65.94 AB	64.48 AB	68.67 A	65.22 A	
	6 ml.L $^{1-}$	64.31 AB	68.50 A	66.88 AB	65.53 A	

interaction between root stock and organic fertilizer	sour orange	60.10 C	64.02 AB	64.68 AB	interaction between root stock and the amino fertilizer	
	poncirus trifoliata	61.83 BC	64.44 AB	66.02 A	sour orange	poncirus trifoliata
interaction between amino fertilizer and organic fertilizer	Control	56.13 D	61.96 BC	61.30 C	60.23 B	59.37 B
	3 ml.L $^{1-}$	62.89 BC	64.20 A-C	68.56 A	64.08 A	66.36 A
	6 ml.L $^{1-}$	63.87 A-C	66.54 AB	66.19 AB	64.50 A	66.56A
Average concentrations of organic (fertilizer(combo		60.96B	64.23A	65.35A		

Coefficients with similar letters in the same column are not significantly different according to Duncan's multinomial test at the 5% probability level.

The results shown in Table 4 indicate that there are no significant differences between the two types of citrus in the N content in the leaves, while spraying with a concentration of 3 ml l^{-1} of Delfan Plus fertilizer led to the highest values for this trait, and treatment with 8 ml l^{-1} of Combo fertilizer resulted in A significant increase in the values of this trait, and the results of the same table indicate that the highest averages for this trait as a result of the binary interactions were when the interaction between a concentration of 3 ml l^{-1} of Delfan Plus fertilizer on the one hand and a concentration of 8 ml l^{-1} of Combo fertilizer for both types of citrus as well as The interaction between the same two concentrations of Delfan Plus and Combo fertilizer. As for the triple intervention, the interaction treatment between a concentration of 3 ml l^{-1} of Delfan Plus fertilizer and a concentration of 8 ml l^{-1} of Combo fertilizer for both types of citrus gave the highest value for this trait.

Table (4): The effect of fertilizer treatments and the interaction between them in Nitrogen content of leaves (%) of sour orange and Poncirus trifoliata seedlings.

		Liquid Organic Fertilizer Concentrations				
Root stock citrus	Amino fertilizers Concentrations	Control	6 mlL $^{1-}$	8 mlL $^{1-}$	Average root stock	
sour orange	Control	0.96 CD	0.99 CD	1.08 B-D	sour orange	1.17 A
	3 ml.L $^{1-}$	1.06 B-D	1.14 B-D	1.73 A	poncirus trifoliata	1.15 A
	6 ml.L $^{1-}$	1.17 BC	1.31 B	1.11 B-D	Average concentrations of amino fertilizer(Delfan plus)	
poncirus trifoliata	Control	0.85 D	1.14 B-D	1.11 B-D	1.02 C	
	3 ml.L $^{1-}$	1.09 B-D	1.03 B-D	1.80 A	1.31 A	
	6 ml.L $^{1-}$	1.09 B-D	1.17 BC	1.08 B-D	1.15 B	
interaction between root stock and organic fertilizer	sour orange	1.06 B	1.15 B	1.30 A	interaction between root stock and the amino fertilizer	
	poncirus trifoliata	1.01 B	1.11 B	1.33 A	sour orange	poncirus trifoliata
interaction between amino fertilizer and organic fertilizer	Control	0.906 C	1.06 BC	1.09 BC	1.01 C	1.03 C
	3 ml.L $^{1-}$	1.07 BC	1.08 BC	1.76 A	1.31 A	1.30 A
	6 ml.L $^{1-}$	1.13 B	1.24 B	1.09 BC	1.20 AB	1.11 BC
Average concentrations of organic (fertilizer(combo		1.03B	1.13B	1.32A		

Coefficients with similar letters in the same column are not significantly different according to Duncan's multinomial test at the 5% probability level.

The type of citrus had no effect on the values of the leaf content of P, while spray with a concentration of 6 ml l^{-1} of Delfan Plus fertilizer and adding a concentration of 8 ml l^{-1} of Combo fertilizer led to a significant increase in the values of this trait. The binary interventions had a positive effect. In this regard, it was found that the highest values were when the interaction between a concentration of 6 ml l^{-1} of Delfan Plus fertilizer and the citrus species Poncirus trifoliata and the interaction between a concentration of 8 ml l^{-1} of the combo fertilizer with the same type and the interaction between a concentration of 6 ml l^{-1} of fertilizer Delfan Plus and adding a concentration of 8 ml l^{-1} of combo fertilizer. As for the triple interaction, it was observed that the interaction was between a concentration of 6 ml l^{-1} of Delfan Plus fertilizer and adding a concentration of 8 ml l^{-1} of combo fertilizer and both types of citrus.

Table (5): The effect of fertilizer treatments and the interaction between them in Phosphorus content of leaves (%) of sour orange and Poncirus trifoliata seedlings.

		Liquid Organic Fertilizer Concentrations				
Root stock citrus	Amino fertilizers Concentrations	Control	6 mlL $^{1-}$	8 mlL $^{1-}$	Average root stock	
sour orange	Control	0.670 CD	0.669 CD	0.729 B-D	sour orange	0.773 A
	3 ml.L $^{1-}$	0.761 B-D	0.723 B-D	0.808 B	poncirus trifoliata	0.809 A
	6 ml.L $^{1-}$	0.795 BC	0.764 B-D	1.040 A	Average concentrations of amino fertilizer(Delfan plus)	
poncirus trifoliata	Control	0.666 D	0.773 B-d	0.745 B-D	0.708 C	
	3 ml.L $^{1-}$	0.765 B-D	0.811 B	0.846 B	0.786 B	
	6 ml.L $^{1-}$	0.789 B-D	0.841 B	1.049 A	0.879 A	
interaction between root stock and organic fertilizer	sour orange	0.742 C	0.719 C	0.859 AB	interaction between root stock and the amino fertilizer	
	poncirus trifoliata	0.740 C	0.808 B	0.880 A	sour orange	poncirus trifoliata
interaction between amino fertilizer and organic fertilizer	Control	0.668 D	0.721 CD	0.737 CD	0.689 E	0.728 DE
	3 ml.L $^{1-}$	0.763 BC	0.767 BC	0.827 B	0.764 CD	0.807 BC
	6 ml.L $^{1-}$	0.792 BC	0.803 BC	1.044 A	0.866 AB	0.893A
Average concentrations of organic (fertilizer(combo		0.741B	0.763B	0.869A		

Coefficients with similar letters in the same column are not significantly different according to Duncan's multinomial test at the 5% probability level.

From the results of Table 6, it is noted that there is no significant increase in the K content values of the leaves for the two types of citrus under study, while the concentrations of Delfan Plus fertilizer achieved a significant superiority in the values of this characteristic, especially when using the concentration of 6 ml l^{-1}, which achieved the highest increase, and the same is true for the concentration of 8 ml $l^{-1}$of the organic combo fertilizer. As for the binary interactions, the results indicate that the highest increase occurred in the interactions between (a concentration of 6 ml $l^{-1}$of Delfan Plus fertilizer, as well as a concentration of 8 ml $l^{-1}$for the two types of citrus, and the interaction between the concentrations 3 and 6 ml $l^{-1}$of amino fertilizer with a concentration of 8 ml $l^{-1}$of organic fertilizer. The triple interactions between the study factors had a significant impact on increasing the trait values, especially when the triple interaction between concentrations 3 and 6 ml $l^{-1}$of amino fertilizer with a concentration of 8 ml $l^{-1}$of organic fertilizer for both types of citrus fruits used in the study.

Table (6): The effect of fertilizer treatments and the interaction between them in Potassium content of leaves (%) of sour orange and Poncirus trifoliata seedlings.

		Liquid Organic Fertilizer Concentrations				
Root stock citrus	Amino fertilizers Concentrations	Control	6 mlL $^{l-}$	8 mlL $^{l-}$	Average root stock	
sour orange	Control	1.18 C	1.26 BC	1.43 A-C	sour orange	1.57 A
	3 ml.L $^{l-}$	1.27 BC	1.46 A-C	2.03 A	poncirus trifoliata	1.62 A
	6 ml.L $^{l-}$	1.55 A-C	1.84 A-C	2.08 A	Average concentrations of amino fertilizer(Delfan plus)	
poncirus trifoliata	Control	1.24 BC	1.27 BC	1.51 A-C	1.32 B	
	3 ml.L $^{l-}$	1.48 A-C	1.52 A-C	1.98 A	1.62 A	
	6 ml.L $^{l-}$	1.68 A-C	1.89 AB	1.99 A	1.84 A	
interaction between root stock and organic fertilizer	sour orange	1.34 B	1.52 AB	1.85 A	interaction between root stock and the amino fertilizer	
	poncirus trifoliata	1.47 B	1.56 AB	1.83 A	sour orange	poncirus trifoliata
interaction between amino fertilizer and organic fertilizer	Control	1.21 C	1.27 C	1.47 BC	1.29 C	1.34 BC
	3 ml.L $^{l-}$	1.38 C	1.49 BC	2.00 A	1.59 A-C	1.66 AB
	6 ml.L $^{l-}$	1.62 A-C	1.86 Ab	2.03 A	1.82 A	1.85A
(Average concentrations of organic fertilizer(combo		1.40B	1.54B	1.84A		

Coefficients with similar letters in the same column are not significantly different according to Duncan's multinomial test at the 5% probability level.

The results of Table 7 confirmed that the two types of citrus fruits, Sour orange and Poncirus trifoliata, did not have any significant difference in the values of the protein content of the leaves. In contrast, the concentrations of Delfan Plus fertilizer recorded a significant increase, especially the concentration of 6 ml l^{-1}, and the same was true for the concentration of 8 ml $l^{-1}$of fertilizer. As for the binary interactions between the factors, it is clear that the interactions occurring between a concentration of 6 ml $l^{-1}$of Delfan Plus fertilizer or a concentration of 8 ml $l^{-1}$of Combo fertilizer for both types of citrus, as well as the interaction between concentrations of 3 and 6 ml $l^{-1}$of Delfan Plus The concentration of 8 ml $l^{-1}$of the combo fertilizer achieved the highest significant values for this characteristic. The results of the table also indicate that the highest significant increase in the values of the protein content of the leaves for the triple interaction between the study factors was achieved by the interaction treatment between the two concentrations of 3 and 6 ml $l^{-1}$of Delfan Plus. With a concentration of 8 ml $l^{-1}$of the combo for both types of citrus.

Table (7): The effect of fertilizer treatments and the interaction between them in Protein content of leaves (%) of sour orange and Poncirus trifoliata seedlings.

		Liquid Organic Fertilizer Concentrations				
Root stock citrus	Amino fertilizers Concentrations	Control	6 mlL $^{l-}$	8 mlL $^{l-}$	Average root stock	
sour orange	Control	7.41 C	7.89 BC	8.97 A-C	sour orange	9.82 A
	3 ml.L $^{l-}$	7.97 BC	9.16 A-C	12.70 A	poncirus trifoliata	10.13 A
	6 ml.L $^{l-}$	9.72 A-C	11.49 A-C	13.03 A	Average concentrations of amino fertilizer(Delfan plus)	
poncirus trifoliata	Control	7.79 BC	7.97 BC	9.47 A-C	8.25 B	
	3 ml.L $^{l-}$	9.27 A-C	9.49 A-C	12.39 A	10.16 A	
	6 ml.L $^{l-}$	10.54 A-C	11.80 AB	12.43 A	11.50 A	

interaction between root stock and organic fertilizer	sour orange	8.37 B	9.51 AB	11.57 A	interaction between root stock and the amino fertilizer	
	poncirus trifoliata	9.20 B	9.75 AB	11.43 A	sour orange	poncirus trifoliata
interaction between amino fertilizer and organic fertilizer	Control	7.60 C	7.93 C	9.22 BC	8.09 C	8.41 BC
	3 ml.L $^{1-}$	8.62 C	9.32 BC	12.55 A	9.94 A-C	10.38 AB
	6 ml.L $^{1-}$	10.13 A-C	11.65 AB	12.73 A	11.41 A	11.59A
Average concentrations of organic fertilizer(combo)		8.78B	9.63B	11.50A		

Coefficients with similar letters in the same column are not significantly different according to Duncan's multinomial test at the 5% probability level.

4. Discussion

Obtaining the highest significant values for vegetative growth characteristics (height and diameter of seedlings and chlorophyll content in the leaves) as a result of foliar spraying with concentrations of amino fertilizer (Delfan Plus), especially the levelof 6 ml l^{-1}, may be due to it containing amino acids, which have a role in increasing the activity of the processes. Physiological processes in plants, especially Formation of enzymes, plant growth regulators, and vitamins. Amino acids also participate in the formation of cell membranes and have a role in building chlorophyll and accumulating carbohydrates, and thus all of this has a positive effect in improving the efficiency of the photosynthesis process., which led to the improvement of the characteristics of vegetative growth (**Yang et al., 2023**).

In addition, foliar spray with concentrations of amino acids led to an increase in the leaves' content of major nutrients (nitrogen, potassium, and phosphorus), Which contributes to various growth processes in the plant, and thus improving the characteristics of vegetative growth (**Nargesi et al., 2022; Khalil et al., 2023**). The results were similar. Our study is in line with what **Al-Hamdani et al. (2020)** confirmed in their experiment on local orange seedlings, *Citrus sinensis* L., that foliar spraying with amino acids caused a significant increase in the vegetative growth characteristics of the seedlings.

Also, the increase in the content of the seedling leaves of mineral elements when spray with a levelof 6 ml l^{-1} of Delfan plus may be due to it containing amino acids that are Important for the plant and which nitrogen is included in their composition. When these acids are sprayed on the leaves, they are absorbed, Therefore, it increases N levels in the shoots, and adding amino acids reduces the osmotic potential, which reduces the water potential of the plant cell and thus increases its ability to withdraw dissolved nutrients from the growth medium and transfer them to the leaves, so the concentration of these nutrients increases (**Singh, 1999**).

This is in line with what **Alalaf et al. (2022)** found in their study on *Citrus grandis* seedlings, and **Abdullah and Alalaf (2023)** on buckthorn seedlings, that foliar spray with fertilizers containing amino acids led to a significant increase in the leaves' content of mineral elements (NPK).

As for the significant superiority obtained in the characteristics of vegetative growth when foliar spray with concentrations of liquid organic fertilizer, especially the levelof 8 ml l^{-1}, it may be explained as a result of the content of the liquid organic fertilizer on important nutrients in plant growth, including nitrogen, which works to increase the content of nucleic acids and the manufacture of important proteins. It stimulates increased cell division and the formation of leaf

roots, as well as The role of nitrogen in the process of photosynthesis and stimulating the plant to produce some growth regulators, especially cytokinins, which have a clear role in stimulating cell division and elongation and stimulating new growth. The fertilizer also contains the element potassium, which is important in regulating The process of opening and closing stomata, thus reducing the process of transpiration. It also has a role in the process of cell division and increasing the growth of meristematic tissues, which leads to increased activity of the cambium layer, thus increasing the size of the shoot and improving its characteristics (**Hagagg et al., 2022**).This was confirmed by the results of **Abd-Alkarem and Alalaf (2022) Al-Aareji, et al .,(2023)** on seedlings of *Citrus grandis* and *Citrus paradise*, that the addition of liquid organic fertilizers caused a significant increase in their vegetative growth characteristics.

Foliar spraying with a levelof of 8 ml l^{-1} of organic fertilizer led to an increase in the concentration of the leaves' content of nutrients. This may be due to the fact that increasing the concentration of fertilizer spraying caused an increase in the leaves' content of nutrients, which led to stimulating vegetative and root growth and obtaining strong-growing seedlings. Thus, increasing the ability of seedlings to absorb large quantities of elements present in the soil and transfer them to the leaves, where they accumulate and their concentration increases. This was confirmed by both (**Shakur and Khawla, 2020)** for buckthorn trees and **Alalaf et al. (2020)** for grapefruit seedlings with *Citrus paradise*.

5.CONCLUSIONS:

from the results obtained, we conclude that spray with both Delfan plus and combofertilizers had a positive role in improving the growth characteristics and mineral content of orange and orange seedlings, especially when using high concentrations of 6 and 8 ml l^{-1}. Therefore, We recommend using these concentrations of both fertilizers to obtain Fast-growing seedlings, with the possibility of using higher concentrations.

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