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Effect of adding liquid organic fertilizer and foliar spraying with amino fertilizer in improving some growth characteristics of Christi Thorn

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ABSTRACT

Seedlings of fruit crops grown in nurseries need fertilization, especially adding fertilizers that contain the nutritional elements that these seedlings need for the purpose of improving their growth, especially in terms of the diameter of the main stem to facilitate the Budding process. This study aimed to demonstrate the effect of two appointments (every 15 and 30 days). To add three concentrations of the liquid organic fertilizer Vivitar (0, 2, and 4 ml L^{-1}) and foliar spraying with three concentrations of the amino fertilizer Techamine Max (0, 2, and 4 ml L^{-1}) to improve some growth characteristics of Christi Thorn seedlings, a randomized block design was used. The complete (R.C.B.D.) designed the experiment that contained three factors, three replicates, and four seedlings for each experimental unit. The most important results obtained showed that the studied characteristics (total chlorophyll in leaves, increase in seedling diameter, and fresh and dry weights) increased significantly when foliar spraying with concentrations of the amino fertilizer (Tikamin Max), especially the concentration of 4 ml L^{-1}, while two additional treatments achieved Liquid organic fertilizer (Vivitar) 2 and 4 ml L^{-1} had the highest increase in the two traits (total chlorophyll in leaves and increase in seedling diameter), while the timings of adding fertilizers (every 15 and 30 days) did not have any significant effect on the traits except through a superior date. Addition (every 15 days) over the time of addition (every 30 days) had a significant effect on the percentage of dry matter in the leaves.

Keywords: Amino fertilizer. Liquid organic fertilizer. Chlorophyll concentration. Diameter of seedlings. Christi Thorn

INTRODUCTION

The thorn Christi fruit belongs to the Rhamanaceae family, and it is one of the evergreen fruits whose cultivation is widespread in the tropical, subtropical, and warm temperate regions of the world. Its original homeland is the Himalayas, southern Europe, and northern China, and it may be the Arabian Peninsula, North Africa, Sudan, and America. Southern (Hauenschild et al., 2016).

The use of natural products, especially organic fertilizers, in horticultural applications has become a major goal in the production of many types of plants, including fruits, due to their effective role in improving the physical, biological and chemical properties of all types of soil and working to increase the readiness of nutrients and equalize soil acidity (pH). It also works to Increasing soil fertility by increasing the percentage of its content of nutrients when it decomposes because it contains these elements and raises the percentage of organic matter in the soil, which leads to an increase in the activity of microorganisms and their secretions, the most important of which are growth regulators, which the plant benefits from through its participation in physiological processes. Increasing organic matter leads to a reduction in the bulk density of the soil, increasing its porosity and increasing its aeration, in addition to its positive effect in increasing the soil's ability to retain water, especially light-textured lands such as sandy lands (Abobatta and El-Azazy, 2020).

The use of soluble organic fertilizers has increased in studies and research aimed at developing fruit seedlings and improving growth characteristics. Shakur and Khawla (2020) noted when they studied the addition of two concentrations of POTGROND

organic fertilizer (0 and 4 kg. tree^{-1}), which contains (90% of Organic matter (organic matter) in the chlorophyll content of the leaves of thorn Christi trees, an apple variety. The addition of organic fertilizer at a concentration of 4 kg. Tree^{-1} resulted in a significant increase in the chlorophyll content of the leaves compared to the control treatment, The study by Abd-Alkarem and Ayad (2022) concluded that adding a fertilizer combination consisting of liquid organic fertilizer (Compo) containing (52% organic matter, 3% organic nitrogen, and 6% potassium in the form of K_2O) at a concentration of 6 ml.L^{-1} with biofertilizer G Gorabac at a concentration of 20 gm. Seedling^{-1} produced a significant increase in most of the studied traits (area of leaf, leaf area of seedlings, total chlorophyll concentration in leaves, length of grafts, increase in number of leaves, and fresh and dry weight of leaves) for both grafted *Citrus grandis* and *Citrus paradise* seedlings.

Foliar spray of fruit seedlings with fertilizers that contain amino acids in their composition leads to accelerating their growth by increasing the leaf surface area and the leaves' content of chlorophyll and nutrients. Amino acids are nitrogenous organic compounds that contain one or more amine groups, and are the structural and basic unit of proteins. It is considered a biostimulant that affects the physiological processes in plant growth. It is a biostimulant that is absorbed and transported quickly within the various parts of the plant and affects the enzymatic activity in the plant. It is an essential component of living matter and protoplasm and is also involved in the formation of enzymes and thus participates in enzymatic reactions in cells (Sarkis et al. ,2022).

Many studies have indicated the importance of foliar spray with amino acids in improving the vegetative growth characteristics of fruit seedlings, including thorn Christi seedlings. Al-Asadi (2018) concluded in his study to demonstrate the response of thorn Christi trees, an apple variety, to foliar spraying with three concentrations of the amino acid tryptophan (0, 100 and 200 mg.L^{-1}) in some vegetative traits. The concentration of 200 mg.L^{-1} of the amino fertilizer gave the highest significant values for the traits (fresh and dry weight of leaves and leaf area) compared to the control treatment that recorded the lowest values for these traits, While Alalaf and others (2022) found in their study to demonstrate the importance of spraying two types of amino fertilizers (Delfan plus and Vegeamino) at five concentrations of each (0, 1, 2, 3, and 4 ml.L^{-1}) in improving growth of (*Citrus grandis*) seedlings, that the two concentrations (3 and 4 ml.L^{-1} of the amino fertilizer Vegeamino caused a significant increase in both traits (increase in height and diameter of seedlings) compared to the rest of the treatments, especially the control treatment.

The aim of the research:

Studies related to the effect of fertilizer feeding on improving the vegetative growth characteristics of buckthorn seedlings are few. Therefore, this study focuses on the importance of adding dates and concentrations of liquid amino and organic fertilizers in accelerating the growth of thorn Christi seedlings and improving their vegetative characteristics to obtain strong seedlings, especially in terms of the diameter of the main stem to facilitate Vaccination process as quickly as possible.

MATERIALS AND METHODS

This study was carried out during the 2022 growing season to study the response of one-year-old sea thorn Christi seedlings to the dates and concentrations of the amino fertilizer (Tikamin Max) and the liquid organic fertilizer (Vevitair). Seedlings that were approximately homogeneous in growth (25-30 cm high and their main stem diameter 2-3 mm) were selected

and planted. In plastic anvils with a capacity of 5 kg, Its characteristics are in **Table (1).**

characteristics	The value	characteristics	The value
Sand (g.kg-1)	50.55	$CaCO_3$ %	6.00
Silt (g.kg-1)	28.00	Ready nitrogen ppm	23.00
Clay (g.kg-1)	21.45	Ready phosphorus mg.l^{-1}	5.00
Soil texture	Mixture	EC (millisiemens.cm^{-1}	3.50
Organic matter %	2.79	(pH)	7.30

Containing an agricultural medium consisting of river soil. The study factors included three factors:

1- Two dates for adding fertilizers (every 15 days and every 30 days), with an amount of 6 additions to each, starting on 8/5 and ending on 8/10.
2- Foliar spray with three concentrations of amino fertilizer (Tikamin Max) (0, 2, and 4 ml.L^{-1}), noting that its components are (total amino acids 14.40%, free amino acids 13%, organic nitrogen 8.0%, and organic matter 50.0%, and the pH is 6.6).
3- Adding three levels of liquid organic fertilizer (Viveter) (0, 2 and 4 ml.L^{-1}) containing (organic nitrogen 5%, potassium dioxide 7%, and organic carbon 7%).

The study was designed in a factorial experiment using a Randomized Completely Block Design (R.C.B.D.). With three factors, three replicates, and four seedlings for each experimental unit, so the number of seedlings used in the experiment was (2 x 3 x 3 x 3 x 4 = 216 seedlings). The results were statistically analyzed using a computer within the SAS program (2001), and the averages of the coefficients were compared using Duncan's multinomial test, at 5% error probability level.

At the end of the growing season, the following traits were measured:

1- Total chlorophyll content of leaves (mg.100g^{-1} fresh weight).
2- Increase in seedling diameter (mm).
3- Fresh weight of leaves (g).
4- Dry weight of leaves (g).
5- Dry matter percentage of leaves%.

RESULTS AND DISCUSSION

Total chlorophyll content of leaves (mg.100g-1 fresh weight): - The concentrations of the amino fertilizer had a clear effect on the leaf content of total chlorophyll **(Table, 2)**, as the results confirm that the highest significant value for this factor was when foliar spraying with a concentration of 4 ml/L^{-1} of this fertilizer, while the lowest significant value was for the comparison treatment, This same concentration of liquid organic fertilizer had a significant impact on the values of this factor, outperforming all treatments including the comparison treatment, which recorded the lowest value for this factor, while there were no significant differences between the dates of adding the two fertilizers, as there was no significant increase between the dates every 15 and 30 days. As for the bilateral interaction between dates and concentrations of the amino fertilizer, it is noted from the results of the same table that the bilateral interaction between foliar spraying at a concentration of 4 ml/l^{-1} of this fertilizer, which was added every 15 and 30 days produced the highest significant value in the values of this factor, while it was the least. A value for the interaction between the comparison treatment and the appointment every 15 days. This is also the case for the binary interaction between the timings and the concentrations of liquid organic fertilizer, as the highest significant value was for the binary interaction between adding a concentration of 4 ml/L^{-1} and the additive

every 15 days, while the interaction treatment was recorded between the comparison treatment. Every 15 days is the lowest significant value for this characteristic. As for the binary interaction between the concentrations of the amino fertilizer and the liquid organic fertilizer, we find that the two interaction coefficients between the foliar spraying (with the amino fertilizer at a concentration of 4 ml/L^{-1} and the addition of liquid organic fertilizer at a concentration of 2 ml/L^{-1}) are also (The amino fertilizer at a concentration of 4 ml/L^{-1} and the liquid organic fertilizer at a concentration of 4 ml/L^{-1}) recorded the highest significant values and outperformed all other binary interactions between the two factors, especially the binary interaction between the comparison treatment for both fertilizers, which recorded the lowest values for the factor.

The results of the same table also show that the triple interaction treatment (foliar spray treatment with amino fertilizer at a concentration of 4 ml/L^{-1} and the addition of liquid organic fertilizer at a concentration of 2 ml/L^{-1} added every 15 days) gave the highest significant value for the chlorophyll content of the leaves and was superior to all Triple interactions except the triple interaction treatment between (foliar spraying with amino fertilizer at a concentration of 4 ml/l^{-1} and adding organic fertilizer liquid at a concentration of 2 ml/L^{-1} and the fertilizer added every 15 days), while the lowest significant values for this factor were in the triple interaction between the two treatments (comparison for both fertilizers and the fertilizer added every 15 days).

Table (2). The effect of levels and adding amino fertilizer (Tikamin Max) and liquid organic fertilizer (viviter) and the interaction between them on the total chlorophyll content of leaves of Christi thorn seedlings.

Addition dates	Amino fertilizers concentrations tecmine max	Liquid organic fertilizer concentrations (Viviter)			Average addition dates	
		Control	2 ml/L^{-1}	4 ml/L^{-1}		
First date after 15 days	Control	1.54 j	1.67 j-i	2.08 h-i	Date 1	2.42 a
	2 ml/L^{-1}	2.24 h-f	2.32 g-e	2.69 d-e	Date 2	2.51 a
	4 ml/L^{-1}	2.64 d-e	3.20 a b	3.45 a	Average concentrations of amino fertilizer Tecmine Max	
Second date after 30 days	Control	1.87 h-i	2.06 h-i	2.29 h-e	1.92 c	
	2 ml/L^{-1}	2.46 d-e	2.70 d-e	2.57 d-e	2.49 b	
	4 ml/L^{-1}	2.82 b-d	2.91 b c	2.98 b c	3.00 a	
Interaction between dates and organic fertilizer	First date after 15 days	2.14 c	2.39 b	2.74 a	Interaction between dates and the amino fertilizer	
	Second date after 30 days	2.38 b	2.55 a b	2.61 a b	1st date after 15 days	2nd date after 30 days
Interaction between amino fertilizer and organic fertilizer	Control	1.70 e	1.86 e	2.18 d	1.76 d	2.07 c
	2 ml/L^{-1}	2.35 cd	2.51 b c	2.63 b c	2.41 b	2.57 b
	4 ml/L^{-1}	2.73 b	3.05 a	3.21 a	3.09 a	2.90 a
Average concentrations of liquid organic fertilizer		2.26 c	2.47 b	2.67 a		

* The averages followed by different letters indicate significant differences between them according to the Duncan test at the level of 5%.

Increase in seedling diameter (mm): It is clear from the results shown in **Table (3)** that foliar spraying with amino fertilizer has a significant effect on increasing the diameter of seedlings, as foliar spraying at a concentration of 4 ml/l^{-1} led to a significant increase in this trait compared to the control treatment, which gave the lowest value for this trait. Also, adding liquid organic fertilizer at concentrations of 2 and 4 ml/L^{-1} gave the highest significant increase in the values of this trait compared to the treatment, which gave the lowest values for

it. At the same time, the application dates (every 15 and 30 days) did not have any significant increase in the values of the trait.

The results indicated that the bilateral interaction between dates and the amino fertilizer had a significant effect on this trait, as the highest significant value was the result of the bilateral interaction between foliar spraying at a concentration of 4 ml/L^{-1} of the amino fertilizer, which was added every 15 and 30 days, and they recorded a significant increase over All interactions, especially the comparison treatment every 30 days, produced the lowest value for this trait. As for the interaction between the application dates and liquid organic fertilizer, it was found that the interaction treatments between adding concentrations of 2 and 4 ml/L^{-1} of liquid organic fertilizer and the addition every 15 and 30 days produced A significant increase in the values of this characteristic is superior to the interaction between the comparison treatment for both fertilizers and during the two dates (15 and 30 days), which gave the lowest values. As for the binary interaction between the concentrations of the amino fertilizer and the liquid organic fertilizer, we find that the highest value was for the two treatments between the foliar spraying at a concentration of 4 ml/ L^{-1} of amino fertilizer + adding 2 ml/ L^{-1} of liquid organic fertilizer and treatment. The interaction between foliar spraying with a concentration of 4 ml/L^{-1} of amino fertilizer + adding 4 ml/L^{-1} of liquid organic fertilizer compared to the interaction treatment between the comparison treatment for both fertilizers, which gave the lowest values. In the case of triple interaction between the study factors, the results in the same table confirm that the highest significant values for this factor were the result of the interaction treatment between foliar spraying at a concentration of 4 ml/L^{-1} of amino fertilizer + 2 ml/L^{-1} of liquid organic fertilizer and the added every 15 that showed superiority of the triple interactions, especially the treatment (the comparison treatment for both fertilizers and the addition time every 30 days), which gave the lowest values for this trait.

Table (3). The effect of the levels and dding the amino fertilizer (Tikamin Max) and the liquid organic fertilizer (viviter) and the interaction between them on the increase in seedling diameter (mm) of Christi thorn seedlings.

Addition dates	Amino fertilizers concentrations Tecmine max	Liquid organic fertilizer concentrations (Viviter)			Average addition dates	
		Control	2 ml/L^{-1}	4 ml/L^{-1}		
First date after 15 days	Control	3.94 e f	4.40 e-d	4.29 e-d	Date 1	4.90 a
	2 ml/L^{-1}	4.03 e-d	4.84 cd	4.59 e-d	Date 2	4.74 a
	4 ml/L^{-1}	4.94 c	6.85 a	6.24 a b	Average concentrations of amino fertilizer Tecmine Max	
Second date after 30 days	Control	3.60 f	3.96 e f	4.23 e-d	1.92 c	
	2 ml/L^{-1}	4.23 e-d	4.81 cd	4.95 c	2.49 b	
	4 ml/L^{-1}	5.01 c	6.10 a b	5.77 b	3.00 a	
Interaction between dates and organic fertilizer	First date after 15 days	4.30 b	5.36 a	5.04 a	Interaction between dates and the amino fertilizer	
	Second date after 30 days	4.28 b	4.96 a	4.98 a	1st date after 15 days	2nd date after 30 days
Interaction between amino fertilizer and organic fertilizer	Control	3.77 d	4.18 d	4.26 cd	4.21 cd	d3.93
	2 ml/L^{-1}	4.13 d	4.82 b	4.77 b c	4.48 b c	b 4.66
	4 ml/L^{-1}	4.98 b	6.47 a	6.01 a	6.01 a	a5.63
Average concentrations of liquid organic fertilizer		4.29 b	5.16 a	5.01 a		

* The averages followed by different letters indicate significant differences between them according to the Duncan test at the level of 5%.

Fresh weight of leaves (g): The results presented in **Table (4)** show that foliar spraying with amino fertilizer at a concentration of 4 ml/L^{-1} led to obtaining the highest fresh weight of leaves, which was significantly superior to the spraying treatment with a concentration of 2 ml/L^{-1} of amino fertilizer, which in turn was not between it and the treatment. The comparison showed no significant differences in the values of this factor. It is also noted from the results of the same table that adding concentrations of liquid organic fertilizer did not significantly affect this factor, as there were no significant differences between all concentrations, including the comparison treatment. This is also the case with regard to the dates of adding fertilizers, which did not It does not have any significant effect on the values of this attribute.

We also note from the results that the binary interaction between amino fertilizer concentrations and application dates significantly affected the values of this factor, especially the binary interaction between (foliar spraying with amino fertilizer at a concentration of 4 ml/L^{-1} every 15 days), which recorded the highest significant values for the fresh weight of the leaves, while The lowest value was for the interaction between (the comparison treatment and the appointment every 15 days). As for the binary interaction between the concentrations of liquid organic fertilizer and the times of addition, the results indicate that all of these interactions did not significantly affect this factor, while the binary interaction between the concentrations of the amino fertilizer had an effect. The organic fertilizer had a significant effect on the fresh weight of the leaves, as the seedlings that were sprayed with a concentration of 4 ml/L^{-1} of the amino fertilizer and added to the liquid organic fertilizer at a concentration of 2 ml/L^{-1} gave the highest significant values for this factor, while the intervention treatment recorded binary between the concentration of 2 ml/L^{-1} of the amino fertilizer and the comparison treatment of liquid organic fertilizer has the least significant values. In the case of the triple interaction between the study factors, it was noted that all of these interactions did not have any significant effect on the values of this characteristic, as there were no significant differences between the interaction of these factors with each other.

Table (4). The effect of the levels and adding the amino fertilizer (Tikamin Max) and the liquid organic fertilizer (viviter) and the interaction between them on the increase in the fresh weight of leaves (g) of Christi thorn seedlings.

Addition dates	Amino fertilizers concentrations tecmine max	Liquid organic fertilizer concentrations (Viviter)			Average addition dates	
		Control	2 ml/L^{-1}	4 ml/L^{-1}		
First date after 15 days	Control	4.05 a	4.77 a	4.32 a	Date 1	4.75 a
	2 ml/L^{-1}	4.00a	4.00 a	4.88 a	Date 2	4.85 a
	4 ml/L^{-1}	5.52 a	5.65 a	5.57 a	Average concentrations of amino fertilizer Tecmine Max	
Second date after 30 days	Control	4.66 a	4.89 a	5.03 a	4.62 ab	
	2 ml/L^{-1}	4.02 a	4.68 a	5.63 a	4.53 b	
	4 ml/L^{-1}	4.49 a	5.26 a	4.96 a	5.24 a	
Interaction between dates and organic fertilizer	First date after 15 days	4.52 a	4.81 a	4.92 a	Interaction between dates and the amino fertilizer	
	Second date after 30 days	4.39 a	4.94 a	5.21 a	1st date after 15 days	2nd date after 30 days
Interaction between amino fertilizer and organic fertilizer	Control	4.35 ab	4.83 ab	4.67 ab	4.38 b	4.86 ab
	2 ml/L^{-1}	4.01 b	4.34 ab	5.25 ab	4.29 b	4.78 ab
	4 ml/L^{-1}	5.01 ab	5.46 a	5.26 ab	5.58 a	4.90 ab
Average concentrations of liquid organic fertilizer		4.45 a	4.88 a	5.06 a		

* The averages followed by different letters indicate significant differences between them according to the Duncan test at the level of 5%.

Dry weight of leaves (g): The results shown in **Table (5)** confirm that foliar spraying with the amino fertilizer caused a significant increase in the dry weight of the leaves, as spraying at a concentration of 4 ml/L^{-1} gave the highest values of this characteristic, was significantly superior to the spray treatment at a concentration of 2 ml/L^{-1}. And the comparison treatment, which in turn, there were no significant differences between them. The results also show that the concentrations of liquid organic fertilizer did not significantly affect this factor, as there were no significant differences in all concentrations of this fertilizer, and the same applies to the application dates (every 15 and 30 days). This did not have any significant effect on the values of this characteristic.

The binary interaction between the concentrations of the amino fertilizer and the dates of addition had a significant effect on this factor, as the results of the same table indicate, as the binary interaction treatment (foliar spraying with a concentration of 4 ml/L^{-1} of the amino fertilizer every 15 days) gave the highest dry weight of the leaves, while the interaction treatment gave (foliar spraying with a concentration of 2 ml/l^{-1} of amino fertilizer every 15 days) has the lowest value for this characteristic. It is also noted that all the binary interactions between the concentrations of the liquid organic fertilizer and the application dates on the one hand, as well as the binary interaction between the concentrations of the amino fertilizer and the liquid organic fertilizer, did not affect it significantly values of this characteristic were significant, as there were no significant differences between all of these interactions. The results also confirmed that all the triple interactions between the study factors did not significantly affect the values of this trait, as there were no significant differences between them.

Table (5). The effect of the levels and adding the amino fertilizer (Tikamin Max) and the liquid organic fertilizer (viviter) and the interaction between them on the dry weight of leaves (g) of Christi thorn seedlings.

Addition dates	Amino fertilizers concentrations tecmine max	Liquid organic fertilizer concentrations (Viviter)			Average addition dates	
		Control	2 ml/L^{-1}	4 ml/L^{-1}		
First date after 15 days	Control	1.37 a	1.62 a	1.36 a	Date 1	1.58 a
	2 ml/L^{-1}	1.37 a	1.37 a	1.55 a	Date 2	1.53 a
	4 ml/L^{-1}	1.91 a	1.87 a	1.83 a	Average concentrations of amino fertilizer Tecmine Max	
Second date after 30 days	Control	1.41 a	1.56 a	1.53 a	1.47 b	
	2 ml/L^{-1}	1.33 a	1.53 a	1.78 a	1.47 b	
	4 ml/L^{-1}	1.50 a	1.71 a	1.53 a	1.72 a	
Interaction between dates and organic fertilizer	First date after 15 days	1.55 a	1.62 a	1.58 a	Interaction between dates and the amino fertilizer	
	Second date after 30 days	1.41 a	1.60 a	1.59 a	1st date after 15 days	2nd date after 30 days
Interaction between amino fertilizer and organic fertilizer	Control	1.39 a	1.59 a	1.45 a	1.45 b	1.50 b
	2 ml/L^{-1}	1.35 a	1.45 a	1.62 a	1.43 b	1.52 b
	4 ml/L^{-1}	1.70 a	1.79 a	1.68 a	1.87 a	1.58 ab
Average concentrations of liquid organic fertilizer		1.48 a	1.61 a	1.58 a		

* The averages followed by different letters indicate significant differences between them according to the Duncan test at the level of 5%.

Percentage of dry matter of leaves %: Amino fertilizer concentrations did not have a clear effect on the percentage of dry matter in the leaves **(Table 6),** as there were no significant differences between all concentrations, while the concentrations of liquid organic fertilizer had a significant impact on the values of this characteristic, as the 2ml/l^{-1} treatment outperformed the 4 ml/L^{-1} treatment did not outperform the comparison treatment. As for the application dates, it was found that there were no significant differences between the two dates (every 15 and 30 days) in the values of the dry matter percentage of the leaves, as every 15 days was significantly superior to every 30 days' values of this factor.

The results of the binary interactions between the study factors show that the interaction between the concentrations of the amino fertilizer and the application times had a significant effect in obtaining the highest values of this characteristic This was achieved through the interaction between foliar spraying with a concentration of 4 ml/L^{-1} of the amino fertilizer every 15 days, While the lowest value of this factor was due to the interference between foliar spraying at a concentration of 2 ml/l^{-1} every 15 days, as for the bilateral interaction between the concentrations of liquid organic fertilizer and the dates of addition, it was found that the highest significant value was recorded as a result of the interference between the concentration of 2 ml/l^{-1} every 15 days compared to the interaction treatment between the treatment of 4 ml/l^{-1} with the appointment every 30 days, which gave the lowest values for this characteristic, as for the bilateral interference between the concentrations of each of the amino fertilizer It was noted that all these interactions did not significantly affect the values of this characteristic. As for the triple interactions between the study factors, the results of the same table confirm that these interactions did not significantly affect the values of this factor, but the highest value was recorded as a result of the triple interaction between the treatment (foliar spraying with a concentration of 4 ml/L^{-1} of amino fertilizer and the comparison treatment of fertilizer). Liquid organic every 15 days).

Table (6). The effect of levels and adding amino fertilizer (Tikamin Max) and liquid organic fertilizer (viviter) and the interaction between them on the dry matter percentage (%) of Christi thorn seedlings

Addition dates	Amino fertilizers concentrations tecmine max	Liquid organic fertilizer concentrations (Viviter)			Average addition dates	
		Control	2 ml/L^{-1}	4 ml/L^{-1}		
First date after 15 days	Control	33.48 a	34.57 a	31.86 a	Date 1	33.56 a
	2 ml/L^{-1}	33.80 a	34.26 a	31.66 a	Date 2	31.74 b
	4 ml/L^{-1}	34.58 a	34.93 a	32.93 a	Average concentrations of amino fertilizer Tecmine Max	
Second date after 30 days	Control	30.27 a	32.06 a	30.46 a	32.11 a	
	2 ml/L^{-1}	33.09 a	32.70 a	30.03 a	32.59 a	
	4 ml/L^{-1}	33.42 a	32.59 a	31.11 a	33.26 a	
Interaction between dates and organic fertilizer	First date after 15 days	33.95 a	34.59 a	32.15 ab	Interaction between dates and the amino fertilizer	
	Second date after 30 days	32.26 ab	32.45 ab	30.53 b	1st date after 15 days	2nd date after 30 days
Interaction between amino fertilizer and organic fertilizer	Control	31.87 a	33.31 a	31.16 a	33.30ab	30.93 b
	2 ml/L^{-1}	33.44 a	33.48 a	30.84 a	33.24 ab	31.94 ab
	4 ml/L^{-1}	34.00 a	33.76 a	32.02 a	34.15 a	32.37 ab
Average concentrations of liquid organic fertilizer		33.11 a	33.52 a	31.34 b		

* The averages followed by different letters indicate significant differences between them according to the Duncan test at the level of 5%.

It was shown from the results that the studied characteristics (total chlorophyll in leaves, increase in seedling diameter, and fresh and dry weights) increased significantly when foliar spraying with concentrations of the amino fertilizer (Tikamin Max), especially the concentration of 4 ml L^{-1}, and this may be explained by the fact that the amino acids It is a growth stimulating factor in plants and an important source of nitrogen, which has an essential role in building enzymes and proteins that are important for the functioning of physiological processes, especially cell division and elongation. Amino acids are also considered biostimulants as a result of their role in increasing the efficiency of the photosynthesis process, building sugars, and forming proteins, which has a positive impact. In improving the vegetative growth characteristics of seedlings, Spray with amino fertilizer also played a role in improving the nutritional status of the seedlings as a result of increasing the efficiency of the photosynthesis process. The chlorophyll content of the leaves increased **(Table 1),** and the accumulation of carbohydrates in the seedlings also increased, which is reflected positively in the increase in the diameter of the seedlings and the dry and fresh weights of the leaves **(Tables 2, 3 and 4).** in addition to increasing the number of branches as a result of increased secretion of some growth hormones such as auxins, cytokinins, and gibberellins, which in turn work to improve the growth of seedlings by increasing the growth of the growing tips, activating them, and increasing elongation, and then all of this was reflected positively in improving the characteristics of vegetative growth (Nargesi et al. 2022, Khalil et al. 2023), These results agreed with what was found by Mahmoud (2022) that adding the amino fertilizer Vegeamino at a concentration of 30 $ml.l^{-1}$ gave a significant increase in the studied vegetative growth characteristics (increase in the diameter of the seedlings, increase in the number of leaves, leaf area, and chlorophyll content in the leaves) compared to the treatment. The comparison that gave the lowest values for these characteristics was for olive seedlings of Bashiqa and Manzanillo varieties.

As for the significant superiority recorded by the two treatments of adding liquid organic fertilizer (veviter) 2 and 4 ml L^{-1} in two characteristics (total chlorophyll in leaves and increase in seedling diameter), this may be due to its role in increasing the readiness of nutrients when added to the soil and the formation of a large root system and thus Absorption of these elements and their transfer to the leaves, where they accumulate, which leads to the activation of vital processes, especially respiration, transpiration, and photosynthesis, thus improving the characteristics of vegetative growth (Hagagg et al., 2022)**.** Also, increasing the absorption of nutrients from the soil and their transfer to the shoots led to an increase in the process of carbon metabolism and synthetic substances in the plant, such as sugars and starch, which led to improved growth characteristics (Syahputra et al., 2021). The results of this study were consistent with the results of Al-Aareji et al. (2023), where It was found that adding VIVITER liquid organic fertilizer at a concentration of 10 $ml.l^{-1}$ recorded a significant increase in the total chlorophyll content of the leaves and an increase in the diameter of the seedlings (compared to the untreated seedlings of Pomello and grapefruit seedlings).

CONCLUSIONS:

The results of the study showed the importance of foliar spray with amino fertilizer (Tikamin Max) as well as adding liquid organic fertilizer (Vivetair) in improving the vegetative growth characteristics of Christi thorn seedlings. Therefore, the study recommends spraying the seedlings with a concentration of 4 ml l^{-1} of amino fertilizer and adding concentrations of 2 and 4 ml. $^{-1}$ liter of liquid organic fertilizer to obtain fast-growing seedlings that reach the budding stage quickly, with the possibility of increasing the concentration used of the two fertilizers.

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الملخص العربي

تأثير إضافة السماد العضوي السائل والرش الورقي بالسماد الأميني في تحسين بعض صفات النمو لشتلات السدر البذرية

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تحتاج الشتلات البذرية لمحاصيل الفاكهة المزروعة في المشاتل الى عملية التسميد خاصة اضافة الاسمدة التي تحتوي على العناصر الغذائية التي تحتاجها هذه الشتلات لغرض تحسين نموها خاصة من ناحية قطر الساق الرئيس لتسهيل عملية تطعيمها، هدفت هذه الدراسة الى بيان تأثير موعدين (كل 15 و30 يوم) لإضافة ثلاث تراكيز من السماد العضوي السائل فيفتير (0 و2 و4 مل لتر-1) والرش الورقي بثلاث تراكيز من السماد الاميني تيكامين ماكس (0 و2 و4 مل لتر-1) في تحسين بعض صفات النمو لشتلات السدر البذرية، استخدم تصميم القطاعات العشوائية الكاملة R.C.B.D في تصميم التجربة التي احتوت على ثلاث عوامل، وبثلاثة مكررات، وبأربع شتلات لكل وحدة تجريبية، وبذلك يكون عدد الشتلات المستخدمة في التجربة (216 شتلة)، بينت أهم النتائج التي تم الحصول عليها أن الصفات المدروسة (الكلوروفيل الكلي في الاوراق والزيادة في قطر الشتلات والوزنين الطري والجاف) ازدادت بصورة معنوية عند الرش الورقي بتراكيز السماد الاميني (تيكامين ماكس) خاصة التركيز 4 مل لتر-1، في حين حققت معاملتي اضافة السماد العضوي السائل (فيفتير) 2 و4 مل لتر-1 أعلى زيادة في صفتي (الكلوروفيل الكلي في الاوراق والزيادة في قطر الشتلات)، بينما لم يكن لمواعيد اضافة الأسمدة (كل 15 و30 يوم) أي تأثير معنوي في الصفات الا من خلال تفوق موعد الإضافة (كل 15 يوم) على موعد الاضافة (كل 30 يوم) معنويا في نسبة المادة الجافة للأوراق.