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The Impact of Organic Fertilizers and Growth stimulators on Leaf Chemical Composition of Pomegranate Seedlings (Selimi Cultivar)

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Abstract

The study was conducted in the nursery of the Department of Horticulture and landscape, College of Agriculture, Tikrit University, during the growing season 2022, on one year old pomegranate seedlings cv. Salimi, in order to know the impact of organic fertilizer (sheep waste) with three levels (M_0=control, M_1=20%, and M_2=40%), and some stimuli with eight levels (S0=control, S1=5000 mg L^{-1} glucose, S2=100 mg L^{-1} IBA, S3=200 mg L^{-1} IBA, S4=100 mg L^{-1} NAA, S5=200 mg L^{-1} NAA, S6= 6 ml seedlings^{-1} Taravert Evo and S7=12 ml seedlings^{-1} Taravert Evo) in the chemical Composition of the leaves of these seedlings. A factorial experiment according to (RCBD) with two factors. The results showed that M_2 treatment significant effect in the chemical characteristics of the leaves in N, P, K, carbohydrates and the C:N ratio reached 2.34, 0.24, 1.46, 11.74 and 5.08%. The application of growth stimulators enhanced seedlings growth, where Taravert Evo gave the best results in the leaf content of N, P, and K. As for the interaction between the treatments, the M_2S_6 interaction treatment achieved a significant superiority in the leaf content of N, P, K, carbohydrates and C:N ratio.

Keyword: organic fertilizer, growth stimulators, pomegranate seedlings, chemical content.

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Introduction

Pomegranate (*Punica granatum* L.), is a temperate fruit crop belongs to the Punicaceae. Its cultivation succeeds in Iraq due to its suitability to environmental conditions, where more than 23 cultivars are grown in Iraq, the most important of them is Salimi cv., the most common variety in the central and southern regions [1]. Pomegranate has nutritional and therapeutic importance because its fruits contain good quantities of vitamins, mineral salts, dyes, fats, carbohydrates, sugars, acids, and protein. All parts of the tree contain some substances with therapeutic qualities, the most important of which are anthocyanin, vitamins (especially vitamin C) and phenolic substances, which act as counteracting substances and inhibit the activity of a number of pathogens [2].

Pomegranate orchards are widely established in the soils that are located on the borders of low-fertile soils, due to the ability of this type to grow and produce within such soils, as it tolerates salinity, high ground water level, alkaline soils, and other soils in which many other types of fruits cannot grow and succeed. However, this is at the expense of the power of growth and production [3].

The process of preparing and transporting deciduous fruit seedlings does not receive sufficient attention from those in charge of it, and there is a possibility of delay in the planting process due to environmental or administrative factors such as lack of workers, the size of the orchard, or the arrival of seedlings before preparing the land and other factors that eventually cause harm to the root system. This will cause a percentage of the seedlings to fail and delay the opening of the buds of others, which will later be reflected in the strength of the vegetative growth during the first planting season. In order to improve the growth of pomegranate seedlings during their first year in the orchard, attention should be paid to adapting and improving the root environment, it is also possible to work on stimulating the growth and development of the root system of those seedlings by using some materials that the sources indicate their ability to perform such functions.

The use of organic fertilizers helps to warm the soil, especially in winter at the root zone, and increases the retention of water in light soils and its influence in heavy soils, and reduces soil erosion by wind and water, and increases microbial activity in the soil [4]. According to Yasushi *et al* [5] organic matter in the soil can play a significant role in salt removal by enlarging the soil pores through physical mixing with the soil. This process enhances water penetration, allowing for the leaching of salts. Additionally, organic matter facilitates water absorption by trees, leading to higher concentrations of water in the leaves. The presence of organic matter has also been shown to positively impact the vegetative growth of trees, as reported by [6].

May work to remove salts from the soil by increasing the size of the pores as a result of the physical mixing of the organic matter with the soil and increasing the penetration of water through it [5], and its absorption by trees and its concentration in the leaves, and improve the vegetative growth of trees [6].

[7] study found that foliar application (Bio) and soil application (HA) significantly increased most of the parameters of olive trees such as on leaf area, Leaf dry weight, Leaf mineral contents (N, K, Mn and Zn), Fruit size, fruit fresh weight, Total yield per tree, oil content and Acidity % as compared with control. [8] investigated the effects of five concentrations of the growth regulator IBA on the cuttings of ten pomegranate cultivars. They found that the highest concentration of IBA (5000 mg L^{-1}) had the most significant effect, increasing the length of the longest branch, the area of

one leaf, and the relative chlorophyll content.

Auxins, including IBA and NAA, are more common and effective in influencing rooting compared to other auxins, as they occupy the forefront of research and scientific experiments because they help to activate roots and improve the vegetative growth characteristics of productive seedlings [9]. Sugars, including glucose and fructose, may be used in improving root systems that are severely damaged or severely pruned by dipping or foliar spraying that increases the strength of the roots, which are cheap, non-toxic and safe compounds for the environment, and this reduces the possibility of seeding shock by treating the transplant during or immediately after it with sugars [10].

Seaweed extracts also contain many macro and micro nutrients such as NPK, Na, Ca, Br, Fe, Mg, Mn, Zn and Cu, and these nutrients in the extracts work with more than one group of growth-stimulating substances such as auxins, cytokinins, proteins and antioxidants that will it improves the plant's nutritional status and improves the efficiency of photosynthesis, which reflects positively on vegetative growth and leads to increased plant resistance to diseases and insects by strengthening the plant's immune system, therefore, these extracts were used as organic fertilizers [11].

Methodology

The experiment was carried out in the fields of the Department of Horticulture and Landscaping- College of Agriculture-Tikrit University, during the growing season 2022, in order to know the effect of organic fertilizer and some growth stimulants on the chemical characteristics of pomegranate seedlings, cultivar Salimi. The study included two factors, the first organic fertilizer (sheep waste) with three levels (M_0=control, M_1=20%, and M_2=40%), added to the soil before transferring seedlings. The second factor growth stimulants with eight levels: (S_0= control, S_1=glucose at 5000 mg L^{-1}, S2= IBA at 100 mg L^{-1}, S3= IBA at 200 mg L^{-1}, S4= NAA at 100 mg L^{-1}, S5= NAA at 200 mg L^{-1}, S6= Taravert Evo 6 ml $seedlings^{-1}$ and S7= Taravert Evo 12 ml $seedlings^{-1}$).

Taravert Evo: A highly concentrated complex of marine algae extracts. A powerful and effective treatment for crops that are exposed to different stress conditions. A good tonic for root formation and development.

Where the solutions were prepared with the specified concentrations in a volume of 10 liters for each, and the roots of the seedlings were immersed in them for 60 seconds and directly planted in previously prepared holes, through March month. The experiment was conducted using a randomized complete block design (RCBD) with three replicates, each experimental unit included one seedling, resulting in a total of 72 seedlings (8 blocks x 3 replicates x 3 seedlings), the means were compared according to Duncan's multi-range method using the statistical analysis program SAS [12].

Studied traits: At the end of the growing season, leaf samples were taken and digested according to [13] method, and the following examinations were performed on them:

1- The nitrogen content of leaves (%): The ratio of nitrogen was determined using a Micro-kldahl apparatus, according to the method of [13].

2- The phosphorus content of leaves (%): The percentage of phosphorus was estimated by the colorimetric method using blue ammonium molybdate and ascorbic acid, and after the color development, the absorbance of the samples was read at a wavelength of 410 nm using a spectrophotometer type EMC Iab V-100 according to the method of [3].

3 -Leaf Potassium Content (%): The potassium content in the leaves was determined using a flame photometer

(Elicocl-378 model) following the method described by [3].

4- Total carbohydrates content of leaves (%): Carbohydrates were determined according to the method of [14], 100 mg of the previously prepared sample was crushed with 10 ml of distilled water in a ceramic mortar, then placed in a test tube, and placed in a centrifuge for 15 minutes at a speed of 3000 rpm, the clear solution was taken and it was placed in a test tube, the volume of the clear solution was added to 10 ml with distilled water, and 1 ml was taken from the solution and 1 ml of phenol 5% and 5 ml of concentrated sulfuric acid were added to it, and it was placed in a water bath for 30 minutes at a temperature of 60 °C and read by a spectrophotometer, the samples were collected and then subjected to centrifugation at 3000 rpm for 15 minutes. Afterward, the clear solution was carefully extracted and transferred into a test tube. The volume of the clear solution was adjusted to 10 ml using distilled water. Next, 1 ml of the solution was mixed with 1 ml of 5% phenol and 5 ml of concentrated sulfuric acid. The resulting mixture was then placed in a water bath at a temperature of 60°C for 30 minutes. Finally, the absorbance of the solution was measured using a spectrophotometer. German-made, type: APel PD-303 at a wavelength of 488 nanometers. The readings were projected onto a standard glucose profile, then the total carbohydrates were calculated according to the following equation:

Total carbohydrates (%)= device reading x dilution x coefficient constant (0.0525) x 100

5 -Leaf Carbohydrate to Nitrogen Ratio: The ratio of carbohydrates to nitrogen in the leaves was determined by dividing the measured carbohydrate content of the leaves by the corresponding nitrogen content values.

Results and discussion:

1- Leaves nitrogen content (%): The results in Table (1) showed that the application of organic fertilizer at 40% rate (M2) resulted in the highest recorded rate of 2.34%, significantly outperforming all other treatments. Moreover, the treatment involving the application of fertilizer at a 20% rate (M1) showed superiority over the control treatment (M0), yielding the lowest value of 1.60%.

The results of the table (1) showed that there were significant differences in the characteristic of the nitrogen content of the leaves when adding growth stimulants, the treatment of adding the commercial stimulus Taravert Evo by 6 ml Seedling^{-1} (S_6) gave the highest value of 2.17%, which did not differ significantly from Taravert Evo by 12 ml of Seedlings^{-1} (S_7) and soaking the roots with growth regulator NAA at a concentration of 200 mg L^{-1} (S_5), while the control treatment (M_0) gave the lowest value of 1.77%

Table (1) Effect of organic fertilizer and stimulants and the interaction between them on the nitrogen content of leaves (%) of pomegranate seedlings, Salimi cultivar

Growth stimulants (mg L^{-1})	Organic fertilizer			Mean of growth stimuli
	M0 (%0.0)	M1 (%20)	M2 (%40)	
S_0 (Control)	1.32 k	1.85 fgh	2.14 cd	1.77 e
S_1 (5000 mg L^{-1} Glucose)	1.42 k	1.91 efg	2.17 bcd	1.83 de
S_2 (100 mg L^{-1} IBA)	1.49 j k	1.97 def	2.17 bcd	1.88 de
S_3 (200 mg L^{-1} IBA)	1.53 jkl	2.00 def	2.23 bc	1.92 cd
S_4 (100 mg L^{-1} NAA)	1.68 hij	2.02 c-f	2.38 ab	2.02 bc
S_5 (200 mg L^{-1} NAA)	1.72 ghi	2.08 cde	2.48 a	2.10 ab
S_6 (6 ml seedlings^{-1} Taravert)	1.83 fgh	2.10 cde	2.59 a	2.17 a
S_7 (12 ml seedlings^{-1} Taravert)	1.80 fgh	2.08 cde	2.53 a	2.14 ab
Mean of organic fertilizer	1.60 c	2.00b	2.34a	

- Values followed by the same letter are not significantly different according to Duncan test (P≤0.05).

The combination of organic fertilizer and stimulants led to noteworthy interactions, resulting in significant differences. Among all the treatments, M_2S_6 exhibited the highest nitrogen content in the leaves, reaching 2.59%, and it demonstrated clear superiority over all other treatments. On the other hand, the control treatment (M_0S_0) recorded the lowest value of 1.32% for leaf nitrogen content.

2- Phosphorous content of leaves (%): The data presented in Table (2) demonstrates significant variations in the phosphorus content of the leaves due to the application of organic fertilizer. The highest recorded value of 0.24% was observed when the fertilizer was added at a 40% rate (M2), followed by a significant difference in the treatment where fertilizer was added at 20% (M1). This treatment, in turn, showed clear superiority over the control treatment, which yielded the lowest value of 0.08% for leaf phosphorus content.

Results in table 2 showed that the application of Taravert Evo by 12 ml Seedling^{-1} (S_7) gave a significant superiority over all treatments except S_6, by giving it the highest mean of 0.23% except for the treatment of adding the commercial stimulus Taravert Evo by 6 ml Seedling^{-1} (S6), while the control treatment (M_0) gave the lowest value of 0.10%.

Table (2) Effect of organic fertilizer and stimulants and the interaction between them on the phosphorus content of leaves (%) of pomegranate seedlings, Salimi cultivar

Growth stimulants (mg L^{-1})	Organic fertilizer			Mean of growth stimuli
	M0 (%0.0)	M1 (%20)	M2 (%40)	
S_0 (Control)	0.04 j	0.11 e-j	0.15 d-h	0.10 d
S_1 (5000 mg L^{-1} Glucose)	0.07 ij	0.12 d-j	0.17 def	0.12 cd
S_2 (100 mg L^{-1} IBA)	0.05 ij	0.11 e-j	0.16 d-g	0.11 d
S_3 (200 mg L^{-1} IBA)	0.09 f-j	0.14 d-i	0.26 c	0.16 bc
S_4 (100 mg L^{-1} NAA)	0.08 g-j	0.13 d-i	0.18 cde	0.13 cd
S_5 (200 mg L^{-1} NAA)	0.09 f-j	0.13 d-i	0.20 cd	0.14 cd
S_6 (6 ml seedlings^{-1} Taravert)	0.10 e-j	0.14 d-i	0.34 b	0.19 ab
S_7 (12 ml seedlings^{-1} Taravert)	0.10 e-j	0.15 d-h	0.44 a	0.23 a
Mean of organic fertilizer	0.08 c	0.13 b	0.24 a	

- Values followed by the same letter are not significantly different according to Duncan test ($P \leq 0.05$).

The interaction between organic fertilizers and stimulants had a substantial impact on the phosphorus content of the leaves. Notably, the M2S7 treatment yielded the highest value of 0.44%, displaying significant superiority over all other interaction treatments. On the other hand, the control treatment (S0M0) recorded the lowest value of 0.04% for leaf phosphorus content. The results highlight the synergistic effect of combining organic fertilizers with specific stimulants in enhancing the phosphorus levels in the leaves.

3- Potassium content of leaves: The addition of organic fertilizer increased the potassium content of leaves (Table 3), he highest potassium content was found in leaves treated with 40% fertilizer (M_2), followed by leaves treated with 20% fertilizer (M_1). The control treatment, with no fertilizer, had the lowest potassium content.

The addition of rooting stimuli increased the potassium content of leaves. The treatment with 6 ml of Taravert Evo (S_6) had the highest potassium content (1.28%), followed by the treatment with 12 ml of Taravert Evo (S_7). The control treatment had the lowest potassium content (0.94%).

The combination of 40% organic fertilizer and Taravert Evo at 6 ml or 12 ml per seedling showed the highest potassium content in leaves (1.85% and 1.73%, respectively), significantly interaction all other treatments. The control treatment had the lowest potassium content (0.60%). These findings suggest that the combination of organic fertilizer and Taravert Evo can synergistically enhance the potassium levels in leaves.

Table (3) Effect of organic fertilizer and stimulants and the interaction between them on the potassium content of leaves (%) of pomegranate seedlings, Salimi cultivar

Growth stimulants (mg L^{-1})	Organic fertilizer			Mean of growth stimuli
	M0 (%0.0)	M1 (%20)	M2 (%40)	
S_0 (Control)	0.60 o	0.93 ijk	1.27 cde	0.94 c
S_1 (5000 mg L^{-1} Glucose)	0.68 mno	1.06 ghi	1.39 bc	1.04 b
S_2 (100 mg L^{-1} IBA)	0.71 mno	1.07 ghi	1.50 b	1.09 b
S_3 (200 mg L^{-1} IBA)	0.65 no	0.89 jkl	1.22 def	0.92 c
S_4 (100 mg L^{-1} NAA)	0.75 lmn	0.98 hij	1.32 cd	1.02 b
S_5 (200 mg L^{-1} NAA)	0.79 lmn	1.00 hij	1.37 bc	1.05 b
S_6 (6 ml seedlings^{-1} Taravert)	0.82 klm	1.17 efg	1.85 a	1.28 a
S_7 (12 ml seedlings^{-1} Taravert)	0.86 jkl	1.12 fgh	1.73 a	1.24 a
Mean of organic fertilizer	0.73 c	1.03 b	1.46 a	

- Values followed by the same letter are not significantly different according to Duncan test ($P \leq 0.05$).

4- Total carbohydrates content of leaves (%): The addition of organic fertilizer increased the total carbohydrate content of leaves (Table 4). The treatment with 20% organic fertilizer (M_1) had the highest total carbohydrate content (1.25%), followed by the control treatment (M_0), which had the lowest total carbohydrate content (1.03%).

Growth stimulants increased the carbohydrate content in leaves. The treatment with glucose solution (S_1) had the highest carbohydrate content (9.85%), followed by the treatments with IBA (S_2) and NAA (S_4) (9.40% and 9.35%, respectively). The treatment with Taravert Evo (S_5) had a lower carbohydrate content (8.40%), and the control treatment (S_0) had the lowest carbohydrate content (6.48%).

The combination of 40% organic fertilizer and growth stimulants (S_1, S_2, or S_4) significantly increased the total carbohydrate content in leaves. The M_2S_1, M_2S_2, and M_2S_4 treatments had the highest total carbohydrate content (14.66%, 13.92%, and 13.90%, respectively), which was significantly higher than the control treatment (M_0S_0) with 4.11%. These results suggest that the combination of organic fertilizer and specific growth stimulants can synergistically enhance the carbohydrate levels in leaves

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Table (4) Effect of organic fertilizer and stimulants and the interaction between them on the total carbohydrate content of leaves (%) of pomegranate seedlings, Salimi cultivar

Growth stimulants (mg L^{-1})	Organic fertilizer			Mean of growth stimuli
	M0 (%0.0)	M1 (%20)	M2 (%40)	
S_0 (Control)	4.11 h	5.98 e- h	9.37 bcd	6.48 c
S_1 (5000 mg L^{-1} Glucose)	5.36 g h	9.53 b- f	14.66 a	9.85 a
S_2 (100 mg L^{-1} IBA)	5.37 g h	8.90 d- h	13.92 a	9.40 a
S_3 (200 mg L^{-1} IBA)	5.10 g h	6.06 c- h	10.10 b	7.09 b c
S_4 (100 mg L^{-1} NAA)	5.56 g h	8.59 c- h	13.90 a	9.35 a
S_5 (200 mg L^{-1} NAA)	5.62 fgh	6.53 d- h	10.34 b	7.50 b c
S_6 (6 ml seedlings^{-1} Taravert)	5.70 fgh	6.66 c- h	10.66 b	7.67 b c
S_7 (12 ml seedlings^{-1} Taravert)	6.09 e- h	8.09 c- h	11.01 b	8.40 a b
Mean of organic fertilizer	5.36 c	7.54 b	11.74 a	

- Values followed by the same letter are not significantly different according to Duncan test ($P \leq 0.05$).

5- The percentage of total carbohydrates: nitrogen in the leaves: The addition of organic fertilizer increased the C/N ratio in leaves. The treatment with 40% organic fertilizer (M_2) had the highest C/N ratio (5.08), followed by the treatment with 20% organic fertilizer (M_1) (3.50). The control treatment (M_0) had the lowest C/N ratio (3.40).

Rooting stimuli increased the C/N ratio in leaves. The treatment with glucose solution (S_1) had the highest C/N ratio (5.22), followed by the treatment with IBA (S_2) (4.86). The treatment with Taravert Evo (S_6) had the lowest C/N ratio (3.48), but it was not significantly different from the treatment with NAA (S_5).

The combination of 40% organic fertilizer and growth stimulants (S_1, S_2, or S_4) significantly increased the C/N ratio in leaves. The M_2S_1, M_2S_2, and M_2S_4 treatments had the highest C/N ratio (6.82, 6.45, and 5.89, respectively), which was significantly higher than the control treatment (M_0S_0) with 3.13. These results suggest that the combination of organic fertilizer and specific growth stimulants can synergistically enhance the C/N ratio in leaves.

Table (5) Effect of organic fertilizer and stimulants and the interaction between them on C:N of leaves (%) of pomegranate seedlings, Salimi cultivar

Growth stimulants (mg L^{-1})	Organic fertilizer			Mean of growth stimuli
	M0 (%0.0)	M1 (%20)	M2 (%40)	
S_0 (Control)	3.13 e	3.30 de	4.39 cde	3.61 d
S_1 (5000 mg L^{-1} Glucose)	3.77 de	5.06 b c	6.82 a	5.22 a
S_2 (100 mg L^{-1} IBA)	3.62 de	4.52 cd	6.45 a	4.86 a b
S_3 (200 mg L^{-1} IBA)	3.35 de	3.10 e	4.56 cd	3.67 d
S_4 (100 mg L^{-1} NAA)	3.36 de	4.24 c d e	5.89 a b	4.50 b c
S_5 (200 mg L^{-1} NAA)	3.35 de	3.16 e	4.13	3.55 d
S_6 (6 ml seedlings^{-1} Taravert)	3.18 e	3.20 e	4.07 cde	3.48d
S_7 (12 ml seedlings^{-1} Taravert)	3.44 de	3.89 cde	4.33 cde	3.89 cd
Mean of organic fertilizer	3.40 c	3.81b	5.08 a	

- Values followed by the same letter are not significantly different according to Duncan test ($P \leq 0.05$).

The observed increase in the concentrations of nitrogen, phosphorus, potassium, and carbohydrates in the leaves, as indicated in Tables 1, 2, 3, and

4, can be attributed to the role of organic fertilizers (sheep waste 40%). Organic fertilizers likely enhance the efficiency of the plant's photosynthesis process and carbohydrate synthesis in the leaves [15]. Another possible reason for this effect could be the organic fertilizers' ability to promote root growth and root spread in the soil, leading to increased absorption of essential elements from the soil. This, in turn, raises the concentration of these elements in the leaves, meeting the plants' requirements for essential nutrients. Consequently, the increased accumulation of these elements in plant tissues facilitates the synthesis of vital compounds such as carbohydrates, amino acids, and proteins, all of which are essential for various growth processes [16]. These findings are in line with previous studies by [17] and [18], further supporting the positive impact of organic fertilizers on plant nutrient uptake and subsequent growth processes. Overall, the results confirm the importance of organic fertilizers in enhancing plant growth and nutrient content, highlighting their role in sustainable and efficient agricultural practices.

Indeed, the low pH of the soil resulting from the addition of organic manure, particularly sheep waste (Especially at the 40% level.), can be a significant contributing factor to the observed improvements in nutrient content in the leaves. The decomposition process of organic materials in the manure releases various acids, which have the capacity to dissolve certain compounds and materials in the soil, effectively releasing nutrients into the soil solution. Consequently, this increases the availability of nutrients for plant uptake, leading to higher concentrations of these nutrients in the leaves [19]. Additionally, organic residues, such as sheep manure, contain a substantial amount of essential nutrients, providing a rich source of available nutrients for the plants. This enhances nutrient absorption by the plants and consequently leads to an increase in their concentration in the leaves. Moreover, the application of organic fertilizer to the seedlings has shown to increase the chlorophyll content and leaf area, which in turn accelerates the production of photosynthetic products, such as carbohydrates. This increased carbohydrate production can stimulate root growth and activity, making the roots more efficient in absorbing nutrients from the soil and accumulating them in the leaves [20]; [21]. Together, these factors contribute to the overall improvement in nutrient content and growth observed in the leaves of the seedlings treated with organic fertilizer, highlighting the importance of organic fertilizers in promoting healthy and nutrient-rich plant development.

Sugars are metabolic substrates that play a role in modulating various processes in plants during different phases of development. Thus, modulating the sugar metabolism can have intense effects on the plant metabolism. Glucose is a soluble sugar, found throughout the plant kingdom. glucose functions as a signaling molecule that modulates various metabolic processes in plants. From germination to senescence, a wide range of processes in plants are regulated by glucose. The effect of glucose is found to be concentration-dependent. Photosynthesis and its related attributes, respiration, and nitrogen metabolism are all influenced by glucose application. The endogenous content of glucose increases when plants are exposed to various abiotic stresses, and it also increases when glucose is supplied exogenously. Glucose accumulation alleviates the damaging effects of stress by enhancing the production of antioxidants and compounds similar to those involved in photosynthetic CO_2 fixation. These compounds act as an osmoticum by maintaining osmotic pressure inside the cell, a pH homeostasis regulator, and a reducer of membrane permeability during stress [22].

Also, the reason for the increase in the carbohydrate content of the leaves is due to an increase in the rates of root lengths treated with auxins, which helped the absorption of nutrients necessary to build chlorophyll and the number of leaves and the consequent increase in the rates of leaf area, it contributed to increasing the content of leaves of chlorophyll, while the increase in the percentage of carbohydrates is due to the fact that these treatments led to an increase in the percentage of total chlorophyll and thus increased the manufacture of food in the leaves, which leads to increased plant growth [23].

Conclusions: Based on the obtained results, it can be concluded that:

1-The addition of sheep manure as an organic fertilizer as part of the cultivation soil of pomegranate seedlings of the Selimi variety in the permanent place has a positive role in improving the chemical content of the leaves of the seedlings.

2-The chemical and vegetative growth traits of pomegranate seedlings during their first cultivation season in the permanent place can be improved by treating the roots with growth stimulators, especially the organic stimulant Taravert Evo as a watering after planting and subsequent stages.

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تأثير السماد العضوي وبعض المحفزات في الصفات الكيميائية لأوراق شتلات الرمان صنف سليمي

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الملخص

اجريت التجربة في حقول قسم البستنة وهندسة الحدائق _ كلية الزراعة – جامعة تكريت خلا ل موسم النمو 2022، على شتلات الرمان صنف سليمي بعمر سنة واحدة، بهدف معرفة تأثير السماد العضوي بثلاثة مستويات (المقارنة M_0 وM_1 وM_2) وبعض المحفزات بثمانية مستويات (المقارنة S_0 و S_1 و S_2 و S_3 و S_4 وS_5 وS_6 وS_7) في صفات النمو الخضري لشتلات الرمان صنف سليمي، طبقت الدراسة كتجربة عاملية وفق تصميم (RCBD) بعاملين تضمنت الوحدة التجريبية شتلة واحدة، وبهذا يكون عدد الشتلات 72(8 ×3×3). بينت نتائج المعاملة بالسماد العضوي بنسبة 40%الى فروقات معنوية في الصفات الكيميائية للاوراق في N,P,K والكاربوهيدرات ونسبة C: N وحققت اضافة المحفزات فروقات معنوية فقد اعطت المعاملة بالاوكسينات فروقات معنوية في محتوى الاوراق من الكاربوهيدرات ونسبة C:N بنيما اعطى المحفز التجاري Taravert evo فروقات معنوية في محتوى الاوراق من N,P,K اما فيما يخص التداخل الثنائي بين المعاملات فقد اعطى فروقات معنوية في محتوى الاوراق من N,P,K والكاربوهيدرات ونسبة C:N .

الكلمات المفتاحية: الأسمدة العضوية، منظمات النمو، شتلات الرمان، المحتوى الكيميائي