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Effect of Organic Fertilizer Bio Health and Nano Calcium on the Growth and Yield of Fig Trees *Ficus carica L.* c.v Waziri under Greenhouse Conditions.

Aram Sabir Ahmed[1] **Mohammed Abdul Aziz Lateef [2]**

[1]*Department of Protected Cultivation, Bakrajo Technical Institute, Sulaimany Polytechnic University, Kurdistan Region IRAQ.*
[2]*Department of Horticulture and Landscape Design, College of Agriculture, University of Kirkuk, IRAQ.*

*Corresponding Author: aram.saber.a@spu.edu.iq

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ABSTRACT

This experiment was undertaken on one of the private farms in the village of Kani Sard in the Sharbazhir district near the Sitak area, which is approximately 35 km northeast of the centre of the Sulaymaniyah Governorate - Iraq. It was designed to study the effect of adding biostimulants and non-fertilizers, individually and in combination, on 54 homogeneous fig trees (*Ficus carica* L. C.v Al-Waziri), three years old, grown under the plastic house. In addition, the treatments consisted of control, added organic fertilizer (Bio Health) at three levels (0, 15, 30) gm. tree^{-1} into the soil, and sprayed with Nano Calcium at three levels (0, 75, 150) mg. L^{-1} on the trees. A randomized complete block design (RCBD) with three replications was performed in a factorial. Several basic characteristics were assessed, including leaf area, chlorophyll concentration, leaf dry matter content, fruit size, fruit weight, total soluble solids content, and total acidity content. The results revealed that treatments, including combining the two greatest concentrations of organic fertilizer and Nano Calcium, were optimal, confirmed progress leaf area, chlorophyll content, and improved leaf dry matter content. The quality of the fruits also significantly increased in terms of size, weight, and total soluble solids content (TSS), which reflected positively on the taste and storage quality, while total acidity decreased, which made the fruits more appealing for consumption.

Keywords**:** biostimulants, nanotechnology, quality, quantity, *Ficus carica* Waziri.

INTRODUCTION

One of the vital edible deciduous fruits of the Moraceae family is the fig (*Ficus carica* L.), which originated in South Asia, with the highest possibility, and then gradually developed into the Mediterranean region, Central Asia, and Transcaucasia[1,2]. Figs are one of the only five fruit plants mentioned in the Holy Quran [3], and researchers also confirmed that figs were considered to be among the important edible horticultural fruits in terms of economic, ecological, and industrial studies and that they are abundant in nutrients vital for human health. According to [4], the total fig production was 1,242,449 tonnes 2022 worldwide. It is of the most significant commercial importance because it is adapted to different edaphon-climatic conditions [5]. In addition, it is the first plant cultivated by humans and is recently an important fruit that can be eaten as dry and fresh consumption, and also used raw, dried, canned, or in other preserved forms. Morphologically, figs comprise both trees and shrubs; the bark is smooth and grey, the common shape of fig is turbinate obovoid, and the colors are green-yellow, copper, creamy, red, and florid, depending on genotypes and variety. In the last decade, to progress in sustainable horticultural fruit production, researchers focused on numerous recent tools, including biostimulants and nano-fertilizers, which can significantly improve fruit quality parameters and make nutrients more available [6,7]. Therefore, the use of BOMFs Bio-Organic Mineral Fertilizer is becoming increasingly significant in modern agriculture. These fertilizers aim to make nutrient use efficient for the plant by decreasing the quantity of artificial fertilizer used with cultivation costs. Subsequently, they increase nutrient use efficiency, which has safe and eco-friendly ecosystems and human health [8].

As mentioned before, one of the tech innovations to achieve a sustainable increase in horticulture food production is biostimulant, which contains natural-origin compounds or microbes to stimulate plant processes to improve nutrient use efficiency and tolerance to abiotic and biotic stresses. Nutrient use efficiency could mean better nutrient absorption from the soil, transportation, storage, and use in plant and root growth, Therefore, Bio Health WSG is a water-soluble, organic fertilizer that is used as a good biostimulant, It is based on humic acid, seaweed and microorganisms (beneficial bacteria and fungi), and this combination can generally effect on property of chemo-physical activity of soil and the increased efficiency rhizosphere to availability more nutrients by improvement of root growth and morphology, physiology and intolerance against abiotic stressors [9]. They could have progressed the shelf life of many plant fruits [10] with healthy plant growth [11]. Furthermore, beneficial bacteria and fungi can have many important impacts, including developing hormonal change balance within plants, the biosynthesis of volatile organic compounds, and a progressed system of tolerance to abiotic stresses by induced auxins and secondary metabolites [12, 13]. Nano-fertilizers are another new stage that is applied in very low doses with a high absorption rate compared to other fertilizers without a negative impact on plant development with growth, nutritional status, and the ecosystem [14, 15, 16].

Recently, several researchers investigated the impact of using different Nano-fertilizers on fruit tree growth and productivity, improving fruit quality and ensuring crop sustainability [17, 18,19, 20]. Therefore, one of the important nutrients and crucial roles in the development of growth fig trees (*Ficus carica*) is calcium ions (Ca^{2+}), which have a major impact on the improved fruit quality and nutrition both during harvest and storage. It is also important to control physiological processes in plants, including root hair lengthening, the formation of pollen tubes, and the movement of stomatal guard cells, cell walls, and membranes, which act as an intracellular messenger within the cell [21,22, 23,24]. Furthermore, in fig orchards, pre-harvest calcium spraying is a potential cultural practice; cross-links between calcium and pectin help stabilize cell wall structures and prevent enzymes from breaking them down [25, 26, 27, 28]. Eventually, they found a good positive correlation between the applied rates of the Nano-bio fertilizers and the tree's vegetative growth and productivity, Thus, the purpose of this study was to examine the effects of applying organic and nano fertilizers on the quantity, quality, and vegetative development characteristics of fig trees grown in greenhouses.

MATERIALS AND METHODS

The Experiment location: This experiment was carried out in a greenhouse during the period of April 1, 2024, to December 31, 2024, at one of the private farms located in the village of Kani Sard in the Sharbazhir district near the Sitak area, which is approximately 35 km northeast of the center of the Sulaymaniyah Governorate – Iraq (latitude: 35°38'25.7"N, longitude: 45°35'12.0"E, altitude). The dimensions of the plastic house are fifty-two meters in length, nine meters in width, and three meters in height. that plastic film polyethylene with 200µm thickness was used to cover the house and also to create the study site: GIS software was utilized as shown in (Figure 2.1).

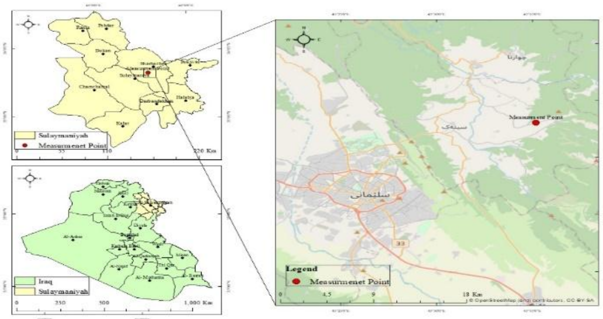

Figure 2.1: The experiment site

Plant materials: 54 homogeneous three-year-old fig trees (*Ficus circa* L. c.v Al-Waziri) were selected and utilized in this study. which were grown using the cordon method and planted at a distance of 2×3 m. (See Figure 2.2)

A B C

Figure 2.2: Illustrated **A**: A fig tree in the cordon method **B**: A branch fog tree with immature fig fruits **C**: Mature fig fruits

Treatments of Experiment

To learn the effect of organic (Bio Health)WSG is a water-soluble, organic fertilizer It is based on humic acid, seaweed, and microorganisms (beneficial bacteria and fungi, Calcium Nano particle fertilizer separately and their combinations on quality and quantity development of fig fruit trees under greenhouse conditions, this study was designed with the treatments as follows: The first factor (B) is Bio Health organic fertilizer per tree at three levels: B1:is Control (0 g. tree^{-1}); B2 is (15 g.

tree^{-1}); B3 is (30 g. tree^{-1}). The second factor (C) is Calcium nanoparticles at three concentrations, C1: sprayed with distilled water; C2: (75 mg L^{-1}); C3: (150 mg L^{-1}).

Agronomic practices and Treatments application

The common agricultural practices inside the greenhouse were performed, such as plowing, weed control, irrigation, thinning, and pruning to control diseases and insects harmful as necessary by using anti-disease. Soil application and foliar spraying methods were performed for all treatments, and Bio Health organic fertilizer was added into the soil using three levels per tree (0, 15, and 30g. tree $^{-1}$), in addition, Nano Calcium was sprayed with at three levels per tree (0, 75, 150) mg. L^{-1} a 16-liter backpack sprayer until completely wet. The fertilizer was added in two batches during the growing season with sprayed in three batches including; the first add (April 16, 2024) and the second (May 16, 2024), And the first spraying after a week of fruit holding (25-5-2024), the second spray after 15 days of the first one, and the third after 15 days of the second spraying.

Data Analysis:

A randomized complete block design (R.C.B.D.) with two factors within the factorial experiments and three sectors was designed and laid out to set up the experiment. The treatments were distributed randomly within each sector at a rate of two trees for each experimental unit, so that 18 trees were selected as one replicate of plants, which was consequently 54 trees obtained for the total experimental unit. The data were analyzed, and the averages were compared using Duncan's multiple-nominal test at a probability level of 5% using the statistical analysis program [29].

The studied traits.

1. Area of a single leaf (cm^2):

Five fully grown and wide leaves from the main fruitful branches were taken from each experimental unit, starting from the third leaf to the sixth leaf from the top of the growths using a computer program according to the method of [30].

2. Chlorophyll concentration in leaves (mg. g^{-1} fresh weight):The relative chlorophyll content was measured by taking (0.25 g) of fully expanded leaves, soaking them in (15 ml of 96% ethanol), for (24 hours) in the shade, and repeating the process twice for a total of (72 hours). Absorbance readings were taken at (649 nm and 665 nm) using a spectrophotometer. Chlorophyll A, B, and total chlorophyll were calculated using the equations as mentioned [31]. Chlorophyll a (mg.gm-1 mw) = (13.70) (A665) – (5.76) (A649); Chlorophyll b (mg.gm-1 mw) = (25.80) (A649) – (7.60) (A665); Total chlorophyll (mg.gm-1 fresh weight) = chlorophyll a + chlorophyll b

A = wavelength (nm). [The chlorophyll concentration was given as ug Chlo mg. dry weight]

3. The average dry weight of one leaf (g. leaf^{-1}):

At the end of August, (five leaves) per unit were collected, washed with plain and distilled water, and then dried using cloth. The wet leaves were dried in an electric oven at (70°C until a constant weight was achieved. The dry matter percentage was calculated using the formula by [32] as follows:

Dry matter% % = dry sample weight (g) / fresh sample weight (g) X 100

4. Total soluble solids (TSS) (%): Portable digital refractometer was used to measure the TSS from fruit juice, firstly, distilled water was utilized to adjust the refractometer, then three drops of the fruit juice were put on the device's sensor, and the TSS was read as an oBrix [33].

5. Total acidity TA (%): It was calculated on the basis that the dominant acid in the juice is citric acid. 0.5 ml of juice sample was put into a small conical flask mixed with d drops of phenol naphthalene indicator and then tittered sample with (0.1N) sodium hydroxide, TA was measured according to the following law [34].

Total acidity%= (citric acid equivalent weight × titer × base volume) / (1000 × juice volume) × 100.

6. Total soluble solids / total acidity: It was calculated by dividing the Total soluble solids (TSS) values by the Total acidity TA (%) values of the fruits [35].

7. Fruit weight (g. fruit^{-1}): two months following the last spraying, ten fruits from each experimental unit were randomly weighed. They were weighed with a sensitive balance, and the mean fruit weight for each treatment was calculated [36].

8. The average fruit size (cm^3): Ten random fig fruits were selected for each experimental unit to measure the size after one month following the last spray using the volume of the displaced water, and then the average fruit size was extracted for each treatment [36].

RESULTS and DISCUSSIONS

The effect of Bio Health, Nano Calcium, and their interactions on leaf area (cm^2) of fig plant were confirmed as shown in Table (1) that used (30 g. tree^{-1}) of Bio Health fertilizer concentration recorded high valve (538.82 cm^2) as compared to control, on the hand the greatest value (507.73 cm^2) was achieved by sprayed (150 mg. L^{-1}) concentration of Nano Calcium as compared to control as well. Regarding the bilateral interaction between Bio Health fertilizer and nano calcium, the results also confirmed that the interaction therapy between Bio Health (30 g. tree^{-1}) and Nano Calcium (150 mg. L^{-1}), which was recorded as the highest area per leaf (566.15 cm^2), outperformed all other interactions.

Table 1: Effect of Bio Health, Nano Calcium, and their interactions on leaf area (cm^2) of Figv *Ficus carica* L. Under plastic house condition

Bio Health g. tree^{-1}	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	402.53 f	411.18 f	449.34 e	421.02 c
15	473.53 d	498.14 c	507.69 c	493.12 b
30	515.45 bc	534.87 b	566.15 a	538.82 a
Average Of Nano Calcium	463.84 c	481.39 b	507.73 a	

In addition, Table (2) demonstrated the role of sprayed both Bio - Nano Calcium fertilizers with their combinations on the leaf content of total chlorophyll (mg. g^{-1} fresh weight), the researcher also recorded that a significant value was obtained after using (30 g.tree^{-1}) of Bio Health fertilizer and (150 mg. L^{-1}) of Nano Calcium individually as showed the highest rate of (22.53 mg. g^{-1} fresh weight, and 21.13 mg. g^{-1} fresh weight) respectively as compared to control. However, the grates rate of total chlorophyll content was confirmed after sprayed fig samples by the interaction of (30 g. tree^{-1}) of Bio Health fertilizer and (150 mg. L^{-1}) of Nano Calcium which was (24.68 mg. g^{-1} fresh weight) as compared to other treatments. The statistical analysis in Table (3) illustrated the significant impact of Bio Health and Nano Calcium fertilizer with combinations on dry matter of leaf (g. Leaf $^{-1}$) of fig samples. The highest value was achieved after utilizing different concentrations of (30 g. tree^{-1}) Bio Health and (150 mg. L^{-1}) Nano Calcium individually and their combination which were (33.05 g. leaf $^{-1}$, 31.25 g. Leaf $^{-1}$ and 37.59 g. Leaf^{-1}) respectively. On the other side, the low values (25.81 g. leaf $^{-1}$, 27.26 g. leaf $^{-1,}$ and 24.03 g. leaf $^{-1}$) were achieved after using the control fertilizer which is (0 concentration) respectively.

Table 2: Effect of Bio Health, Nano Calcium, and their interactions on Total chlorophyll content of (mg. g fresh weight^{-1}) Fig *Ficus carica* L. under plastic house conditions

Bio Health g. tree^{-1}	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	15.46g	18.02f	18.57ef	17.35c
15	18.80ef	19.56de	20.14cd	19.50b
30	20.62c	22.28b	24.68a	22.53a
Average Of Nano Calcium	18.29c	19.95b	21.13a	

Table 3: Effect of Bio Health, Nano Calcium, and their interactions on dry matter of leaf (gm. Leaf $^{-1}$) of Fig *Ficus carica* L. under plastic house condition

Bio Health g. tree^{-1}	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	24.03f	26.34e	27.06de	25.81c
15	27.67de	28.60cd	29.09cd	28.45b
30	30.09bc	31.48b	37.59a	33.05a
Average Of Nano Calcium	27.26c	28.81b	31.25a	

The results of Table (4) also showed the meaningful effect of Bio-organic and Nano Calcium fertilizer and their interactions on the percentage of total soluble solids (TSS) in fig juice fruits. A significant effect of (30 g. tree^{-1}), Bio Health concentration was recorded (18.33 % ºBrix) as compared to the control treatment, which was verified as the lowest percentage (15.04 %ºBrix). In addition, A dosage of (150 mg. L^{-1}) Nano Calcium significantly proved the highest TSS percentage (17.45 %ºBrix) as Compared to the control which had the lowest percentage (15.97ºBrix). The statistical analysis also showed that the binary interaction between Bio Health and Nano Calcium fertilizer had a significant effect on the TSS ratio of (19.23 %ºBrix) after using (30 g. tree^{-1}) of Bio Health and (150 mg. L^{-1}) of Nano Calcium. However, the lowest value (13.90 %ºBrix) was recorded after the control interaction (0 g. tree^{-1}) Bio Health and (0 mg. L^{-1}) Nano Calcium ratio. Total acidity (TA) was assessed from fig juice after applied Bio and Nano Calcium fertilizers separately and their combination is shown in Table (5), The highest acidity percentages of (0.31 and 0.27) were confirmed in both Bio Health and Nano Calcium control (0 g. tree^{-1}) treatment respectively as compared to other treatments. On the other hand, treatment, the statistical analysis also showed that the binary interaction between Bio Health and Nano Calcium fertilizer had a non-significant effect on the TA ratio as (0.174) after using (30 g. tree^{-1}) of Bio Health and (150 mg. L^{-1}) of Nano Calcium. The highest acidity (0.35) was recorded in a comparative treatment. The results in Table (6) observed the significant influence of Bio Health fertilizer on the TSS /TA ratio. The fertilizer treatment (0 g. tree^{-1}) had the highest ratio (80.309, 72.842) for both Bio Health fertilizer (0 m. tree^{-1}) and Nano Calcium (0 mg. L^{-1}). At the same time, low values were obtained from concentrations (30 g. tree^{-1}) of Bio Health and (150 mg. L^{-1}) of Nano Calcium which had the lowest value (60.159 and 66.03) respectively. In terms of the interaction between Bio Health fertilizer and Nano Calcium, the results showed that no significant effect was demonstrated from the interaction between (0 g. $tree^{-1}$) Bio Health and (0 mg. L^{-1}) of Nano Calcium with (0 g. $tree^{-1}$) Bio Health and (75 mg. L^{-1}) of Nano Calcium which were verified the highest TSS/TA ratio (84.148 and 81.72) respectively as compared to other interaction treatments.

Table 4: Effect of Bio Health, Nano Calcium, and their Interactions on Total Soluble Solid % (TSS) of Fig *Ficus carica* L. under plastic house conditions

Bio Health g. $tree^{-1}$	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	13.90g	15.23f	16.00ef	15.04c
15	16.43de	16.80cde	17.13cd	16.79b
30	17.57bc	18.20b	19.23a	18.33a
Average Of Nano Calcium	15.97c	16.74b	17.45a	

Table 5: Effect of Bio Health, Nano Calcium, and their Interactions on Total Acidity % *Ficus carica* L. under plastic house conditions

Bio Health g. $tree^{-1}$	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	0.35a	0.30b	0.27c	0.31a
15	0.25cd	0.24d	0.24d	0.24b
30	0.21e	0.19f	0.174g	0.19c
Average Of Nano Calcium	0.27a	0.24b	0.228c	

Table 6: Effect of Bio Health, Nano Calcium, and their Interactions on TSS % / TA % ratio of Fig *Ficus carica* L. under plastic house conditions

Bio Health g. $tree^{-1}$	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	84.148a	81.723a	75.057b	80.309a
15	68.472cd	70.000c	68.411cd	68.961b
30	65.908d	59.938e	54.630f	60.159c
Average Of Nano Calcium	72.842a	70.554b	66.033c	

The statistical analysis in Table (7) shows that applied Bio-Nano Calcium fertilizer to fig trees had a substantial influence on the average weight of the fruits. The Bio Health concentration (30 g. $tree^{-1}$) produced the highest average weight (104.76 g), significantly superior to the other concentrations, while the comparison treatment (0 g. $tree^{-1}$) recorded the lowest average weight (75.51 g). Whereas, (150 mg. L^{-1}) Nano Calcium treatment had a significant effect on the average weight (96.55 g) as compared to the control (84.30 g). Regarding the combination treatments, the highest fruit weight average of (110.13 g) was obtained between (30 g. $tree^{-1}$) of Bio Health and (150 mg. L^{-1}) of Nano Calcium. In contrast, the interaction between (0 g. $tree^{-1}$) of Bio Health and (0 mg. L^{-1}) of Nano Calcium, the lowest weight average (66.97 g) was noted.

Finally, Table (8) also confirmed that significant fig fruit size was achieved after using Bio Health and Nano Calcium fertilizer. Results also documented that the maximum fruit size (115.03 cm³) was achieved in the Added (30 g. $tree^{-1}$) of Bio Health fertilizer, whereas the smallest size (88.57 cm³) was achieved in the control treatment (0 g. $tree^{-1}$). In addition, sprayed Nano Calcium at a dosage of (150 mg. L^{-1}) resulted in the highest fruit size of (107.46 cm³), while a concentration of (0 mg. L^{-1}) yielded the least size of (95.05 cm³). Regarding, the combination of Bio Health fertilizer (30 g. $tree^{-1}$) and Nano Calcium (150 mg. L^{-1}) largest fruit size (120.00 cm³) was verified. In comparison, the lowest fruit size (78.20 cm³) was obtained from interacted (0 g. $tree^{-1}$) of Bio Health and (0 mg. L^{-1}) of Nano Calcium.

Table 7: Effect of Bio Health, Nano Calcium, and their interactions on the average weight of fruit of Fig (g. $fruit^{-1}$) *Ficus carica* under L. plastic house condition

Bio Health g. $tree^{-1}$	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	66.97g	77.62f	81.93e	75.51c
15	85.85de	89.91d	97.58c	91.11b
30	100.07bc	104.07b	110.13a	104.76a

Average Of Nano Calcium	84.30c	90.53b	96.55a	

Table 8: Effect of Bio Health, Nano Calcium, and their interactions on the average volume of fruit (cm^{-3}) of Fig *Ficus carica* L. under plastic house condition

Bio Health g. $tree^{-1}$	Nano Calcium mg. L^{-1}			Average of Bio Health
	0	75	150	
0	78.20f	91.33e	96.17d	88.57c
15	97.10d	98.67d	106.20c	100.65b
30	109.87c	115.23b	120.00a	115.03a
Average Of Nano Calcium	95.05c	101.74b	107.46a	

The application of Bio Health fertilizer to fig trees resulted in a considerable increase in leaf area, total chlorophyll content of leaves, and dry leaf weight, as indicated in Tables (1,2,3). This is due to the role of organic fertilizer, which increases the permeability of cell membranes and nutrient absorption [37], as it activates and divides cells and increases chlorophyll, which increases the photosynthesis process and the amount of carbohydrates, thereby increasing vegetative growth and positively affecting crop yield. It resulted in a significant increase in the number of fruits, fruit weight, and the percentage of total dissolved solids, as shown in Tables (4, 7, 8), as well as a decrease in the percentage of total acidity and the rate of total dissolved solids to the percentage of total acidity, as shown in Tables (4, 5, 6, 7, and 8), [38,39]. Foliar application of Nano Calcium resulted in a significant increase in leaf area, total chlorophyll content of leaves, and dry matter weight, as shown in Tables (1, 2, 3). This is because the chelating and Nano-composites preserve the element in a way that facilitates its absorption and transfer by the plant. Calcium activates enzymes involved in respiration and electron transport [40]. Spraying the vegetative group with Nano Calcium, which is one of the microelements that stimulate vegetative growth, plays a vital role in strengthening plant cell walls, and increasing vegetative growth leads to increased absorption of elements by the plant [41,42,43,44], which leads to an increase in vegetative growth and thus reflected positively on the quantitative and qualitative characteristics of the crop and had a significant effect on an increase.

CONCLUSION

Based on the obtained results, we conclude the following: Applying organic fertilizer Bio Health at a concentration of (30 g. $tree^{-1}$) showed significant superiority in the studied traits, including leaf area, chlorophyll content in leaves, dry leaf weight, and total soluble solids (TSS) in fig fruits, weight and size of fruit. As for Nano Calcium, the third level at a concentration of (150 mg. L^{-1}) demonstrated a positive effect in improving leaf characteristics and fruit quality. This led to enhancements in growth and increased productivity, including higher chlorophyll content, larger leaf area, increased dry leaf weight, and improved fruit size and weight. The binary interaction between the organic fertilizer and Nano Calcium exhibited a complementary effect, improving all studied traits.

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تاثير السماد العضوي Bio Healthو الكالسيوم النانوي على نمو وأنتاجية أشجار التين تحت ظروف البيت البلاستيكي صنف الوزيري *Ficus carica L.*

محمد عبدالعزيز لطيف **ئارام صابر أحمد**
[1]*قسم الزراعة المحمية ، معهد بكرجو التقني ، جامعة السليمانية التقنية ، إقليم كردستان العراق.*
[2]*قسم البستنة وهندسة الحدائق، كلية الزراعة، جامعة كركوك، العراق.*

الخلاصة
أجريت هذه التجربة في إحدى المزارع الخاصة الواقعة في قرية كاني سارد في قضاء شربازير بالقرب من منطقة سيتك والتي تبعد حوالي 35 كم شمال شرق مركز محافظة السليمانية - العراق خلال موسم النمو (2024) من 1-4-2024 إلى 31-12-2024 على أشجار التين بعمر ثلاث سنوات المزروعة بطريقة الكوردونية والمزروعة على مسافة (2×3) م، داخل البيت البلاستيكي، تم اختيار 54 شجرة متجانسة من حيث الحجم وقوة النمو، وذلك لدراسة تأثير إضافة السماد العضوي (***Bio Health***) بثلاثة مستويات (0، 15، 30) غم .شجرة-1 إلى التربة والرش بالنانو كالسيوم بثلاثة مستويات (0، 75، 150)غم .لتر-1 باستخدام مرشة ظهرية سعة 16 لتر
حتى البلل الكامل، أما بالنسبة لأشجار المقارنة فقد تم رشها بالماء المقطر وتمت عملية الرش مساء وتم إضافة السماد على دفعتين ورش على ثلاث دفعات خلال موسم النمو 2024 في أوقات مختلفة تاريخ إضافة الأولى (2024/4/16) والثانية (2024/5/16) والرشة الأولى بعد أسبوع من العقد (2024/5/25) والثانية بعد 15 يوم من الرشة الأولى والثالثة بعد 15 يوم من الرشة الثانية وتم تنفيذ العمليات الخدمية الزراعية اللازمة في البيت البلاستيكي من حرث وتقليم وتعشيب وري وإزالة الحشائش ومكافحة الأمراض والحشرات كلما دعت الحاجة وتم تنفيذ عملية تقليم الأشجار في نهاية شهر يناير والتصميم المستخدم لتنفيذ التجربة هو تصميم القطاعات العشوائية الكاملة (***R.C.B.D***) بعاملين ضمن التجارب العاملية وثلاثة قطاعات. وتم توزيع المعاملات عشوائيا داخل كل قطاع بمعدل شجرتين لكل وحدة تجريبية بحيث يكون عدد النباتات في المكرر الواحد 18 شجرة وعدد النباتات في التجربة الكلية 54 شجرة وتم تحليل البيانات ومقارنة المتوسطات باستخدام اختبار دنكن المتعدد الحدود عند مستوى احتمال 5% باستخدام برنامج التحليل الإحصائي.
تم تقيم العديد من الخصائص الأساسية، بما في ذلك مساحة الورقة، محتوي الكلوروفيل الكلي، محتوى المادة الجافة للورقة، حجم الثمار، وزن الثمار، محتوى المواد الصلبة الذائبة الكلية، ومحتوى الحموضة الكلي. أظهرت النتائج أن المعاملات التي تضمنت الجمع بين أعلى تركيزين من السماد العضوي والكالسيوم النانوي كانت الأمثل، حيث أدت إلى تحسين مساحة الورقة، وزيادة محتوى الكلوروفيل، وتحسين محتوى المادة الجافة للأوراق. كما زادت جودة الثمار بشكل ملحوظ من حيث الحجم والوزن ومحتوى المواد الصلبة الذائبة الكلية(***TSS***) ، مما انعكس إيجابيًا على الطعم والجودة التخزينية، في حين انخفضت الحموضة الكلية، مما جعل الثمار أكثر جاذبية للاستهلاك .

الكلمات المفتاحية: المنشطات الحيوية، النانوتكنولوجيا، الجودة، الكمية، Waziri *Ficus carica*.