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Effect of Adding NanoFertilizer NPK and Humic Acid on the Vegetative Characterstics of Olive Seedlings, Cultivar Qaysi

Hamid Hammood Mhawesh[1] and Noor Al-Huda Jallel Mohsen[2]

[1]Horticultuere and Garden Engineering, College of Agriculture and Marshlands, University of Thi-Qar, Thi-Qar, Iraq.
[2] Horticultuere and Garden Engineering, College of Agriculture and Marshlands, University of Thi-Qar, Thi-Qar, Iraq
[1]E-mail: hamidh199154@gmail.com
Hamid.h.mhawesh@utq.edu.iq
[2]E-mail: nooralhuda-m@utq.edu.iq
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Abstract. The study was carried out at University of Thi-Qar Governorate on 02.02.2021; the experience finished on 15.06.2021 on olive seedlings at one year age, by three seedlings for each experimental unit. Thus the number of seedlings was 81 at anvils plastic, which was filed by soil and peatmoss at a ratio of 3:1. The experiment included fertilizer treatment Nano NPK which spray on plant leaves at concentrations (0, 25, 75) mg. l, by three additions at 15 days period between each addition. Humic acid was added to the soil at concentrations (0, 1, 2) g. The experiment was carried out by three replication according to Randomized Complete Block Design (RCBD). The results were compared according to less difference test than 5 % possibility. Results analysis statistics showed; the superiority of Nano- NPK fertilizer in height, branches number, leave number and leaves area. It reached (53.00 cm, 14.78 branches. plant^{-1}, 176.77 leaves. plant-1, 5.22 cm2, 65.43 mg. g^{-1} fresh weight) respectively, with the lowest control treatment value. As for humic acid, it was superior in leaves number, and chlorophyll was 144.78 leaves. plant^{-1}, 65.30 mg.g^{-1} fresh weight , respectively, compared to control treatment. As for the interaction, the N2H2 treatment was significantly superior to branches number, leaves number, leaf area, and total chlorophyll. N2H1 treatment was also superior to height plant and stem diameter, which significantly affected.

Keywords. The olive tree, Nano NPK, Humic acid.

1. Introduction

The olive tree, Olea europaea L., is a fruitful and economically significant tree belonging to Olea ceae, which belong to the genus Olea. The origin of the olive tree and its first source is not precisely known, as fossils of olive leaves were found in Africa that belongs to the Old Stone Age It is traditionally found in the Mediterranean basin. This species is grown in all Mediterranean countries, [1]. The olive tree is an evergreen tree in the semi-tropical regions; its size is medium, its length is 4-8 m, and it may reach 22 m. The head of the tree has a spread of 6-10 m, and the tree is characterized by its longevity, which extends for a few centuries. The tree begins to give the crop late at the age of 5-7 years because of the

long period of juvenile that the trees go through, so it is delayed in giving the crop. Olive leaves are simple, evergreen, small in size, with an average length of 7 cm and a width of up to 2 cm, spear-shaped, elongated, tapered, leathery opposite, on the branches, and the new leaves are lighter in color than the large leaves, which may remain for a year and then fall off [2].

The olive tree is one of the species that adds an element of beauty to the natural environment of gardens, and olive oil has its health importance, which is not only due to its high percentage of unsaturated fatty acids / saturated fatty acids, but also because it contains natural antioxidants. [2]. The occurrence of the name of the olive tree in the Qur'an gave it an important space in Islamic culture. It was mentioned six times explicitly and once by reference in the Quran, and there were talkings of the prophet.

The global production of olives in 2019 amounted to about (19,464,495) tons, and the cultivated areas amounted to (10,578,246) hectares. Spain ranks first in the list of olive-producing countries as it produces more than a quarter of the world's production, Italy comes in second place, and then Morocco, Turkey and Fifthly Greece [3]. The number of fruitful olive trees in Iraq for 2020 is estimated at approximately 1,329,191 trees, producing up to 33,912 tons, and the average production per tree is about 25.51 kg. Anbar Governorate ranked the first in production, followed by Ninawa Governorate and then the Governorate of Baghdad [4].

Some reasons lead to an increase in the costs of fruit tree production, including the slow growth in seedlings after their transfer to the permanent place, a long period of its youth and the difficulty of reaping its fruits. Several studies have been conducted that dealt with how to improve the growth of olive seedlings, including fertilization, which is one of the most important agricultural processes that encourage the development of seedlings because of its many benefits in terms of increasing the representation of nutrients, the formation of carbohydrate and nitrogen compounds, increasing the amount of chlorophyll and the growth of vegetative branches and increasing the number of knotted fruits And then increase the quotient [1,5]. To grow well and economically, seedlings of fruits of all kinds need the availability of nutrients in a ready-made form in the soil in which they are planted. These elements must be sufficient and present in ways that the roots of plants can absorb and benefit from،Nutritional elements play a prominent role in the growth and development of plants, and fertilization with the element has a direct role in most of the biological and physiological processes that take place in plants. It also participates in the analysis of carbohydrates that result from the process of photosynthesis and produces the energy necessary for construction processes, in addition to its role in the formation of cellular membranes. It is also considered that its absence or any deficiency in its provision leads to a decrease in the rate of formation of carbohydrates and the formation of amino acids and proteins. [6,7].

As a result of the increase in the use of chemical fertilizers in the recent period and the possibility of negative consequences of adding them to the soil, groundwater and air pollution, potential damage to human and animal health and microorganisms, and economic losses as a result of the loss of chemical fertilizers. Still, it extends to the different vital reactions inside the plant, and it is worth noting that the excessive use of these fertilizers leads to environmental degradation. Therefore, researchers are now turning to the use of nanotechnology in the field of agriculture to produce fertilizers, as it reduces the loss of added nutrients as well as the immediate benefits plants from them because the fertilizers prepared with nanotechnology are environmentally friendly and of critical importance to promoting sustainable agricultural development, as this technology enabled the retention of providing nutrients and releasing them slowly in line with the plant's need for them, so these fertilizers are called innovative fertilizers [8]. The organic matter added to the soil improves the physical properties, builds the soil, and increases its aggregates' stability and ability to hold water Humic acid (HA) is a heterogeneous mixture of many compounds, and it is a mixture of organic acids.Aliphatic and weakly aromatic, they are insoluble in water under acidic conditions but soluble in water. Under alkaline conditions (Chen and [9,10].

This study aims to evaluate the effect of the concentration of humic acid and the NPK compound fertilizer used in foliar spraying onVegetative growth characteristics of olive seedlings

2.Materials and research methods

The experiment was conducted on the farm of the College of Agriculture, Dhi Qar University, during the agricultural season of 2022, in order to study the effect of spraying with humic acid and nanocomposite fertilizer. The seedlings olive were planted in pots, and the seedlings were one year old.The soil at the study site is characterized by its mixed texture, and samples were taken from anvils

Before planting, to identify some of the physical and chemical properties of this soil, samples were collected from the soil of the study siteDepartment of Horticulture, and sent to the laboratory

Table 1. Physical and chemical characteristics of the experimental soil during the growing season.

Analysis type	Analysis' results	Measuring unit
Sand	780	
Silt	118	g.kg-1
Clay	102	
PH	7.50	
EC	2.17	ds. m^{-1}

1.1. Study Factors

1.2. The First Factor

1.3. The first effect is humic acid The seedlings were sprayed with humic produced by Al-Zohour Company for Agricultural Investment and Development, at three concentrations (0-1-2) g/L, between one addition and another for 14 days.

The second effect is the NPK compound fertilizer, which was also used in three concentrations (0 - 25 - 75) mg.l. Spraying is done until complete wetness.

1.4. Statistical Analysis

The experiment was applied according to a completely randomized block design and the means With three replicates were compared according to the least significant difference test at the 0.05 probability level. [11.].

1.5. Studied Characteristics

1.5.1. Increase in Seedling Height (cm)

The seedling height rate was measured using a measuring tape from the surface of the soil to the top of the seedling

1.5.2. The Increase in the Diameter of the Main Stem (mm)

The stem diameter was measured using the foot (Vernier) at the end of the experiment on 06.08.2021.

1.5.3. The Increase in Branches Number (branch. seedling^{-1})

Calculate the number of branches for the specific seedling and then take the average number of branches

1.5.4. The Increase in Leaves Number (leaf. seedling^{-1})

The total number of leaves for the seedlings of the experimental unit was calculated and then averaged.

1.5.5. Leaf Area (cm^2)

The area of each leaf was calculted by taking an average of 5 sheets using the scanner and then reading the area of the sheets by using the Digimizer program.

1.5.6. Total Chlorophyll Content of Leaves (mg.g^{-1} fresh weight)

On 06.12.2021, total chlorophyll in leaves of olive seedlings was estimated according to Mackinney method [12], modified by [13]. The fully-grown leaves were taken from the middle of the growths and then washed with distilled water to get rid of the dust that got stuck in them, then they were placed on blotting paper to get rid of the water that got stuck in them during washing. Take 200 mg of

it, crush it well with 80% acetone using a ceramic mortar, and put it in a centrifuge for five minutes at 3000 revolutions. min^{-1}, then take the filtrate and complete it to the required volume with 80% acetone. A Spectrophotometer read the light absorption at wavelengths 663, and 645 nm and the total chlorophyll was calculated according to the following equation:

$$Chl.A = 12.7A663 - 2.69A645$$

$$Chl.B = 22.9A645 - 4.68A663$$

$$Chl.T = 20.2A645 + 8.02A663$$

Whereas A663 and A645 represent the device's reading at wavelengths 663 and 645 nanometers, respectively.

2.1. The Increase in Seedlings' Height (cm)

The results of Table (2) showed that the effect of the NPK Nano- fertilzer in the rate of increase in plant height was significant. The level N2 recorded a higher average concentration of 53.00 cm relative to the N1 level, which gave 49.88 cm, respectively, which outperformed the control treatment that gave the lowest average at 47.47cm.

As for the second factor, humic acid had an insignificant effect on plant height. The results included that the inter action has a sign ificant impact; the treatment N2H1, which amounted to 54.33 cm, outp erformed the treatment of N0H1, which gave the lowest value for this trait at 45.33 cm.

2. Results

Table (2. The >effect of NPK Nano-fertilizer, humic acid and the inter action between them on plant height cm for olive seedlings.

NPK Nano Fertilizer Concentrations	Humic acid concentrations			Fertilization rate
	H0	H1	H2	
N0	46.47	45.33	50.33	47.37
N1	52.00	49.33	48.33	49.88
N2	52.67	54.33	52.00	53.00
Humic acid level	50.38	49.66	50.22	
	LSD $_{0.05}$			
N=0.001		H= NS		N*H=0.001

2.2. Increase in Branches Number (branch. $plant^{-1}$)

The results of Table (3) show that the effect of the compound nano-fertilizer the rate of increase in plant height was significant, and the level N2 recorded the highest average of 78.14 branches. $plant^{-1}$ about treatment N1 and the control, which gave 11.89 branches. $plant^{-1}$, respectively.

Also, the second factor, humic acid, had an insignificant effect. The interaction significantly impacted treatment N2H2 which amounted to 18.00 branch. $plant^{-1}$ out performed treat ment N1H1, which gave the low value for this trait at 9.67 branches. $plant^{-1}$ (Table 3).

Table (3. The effect of NPK Nano-fertilizer, humic acid and the interaction between them on branches number for olive seedlings (branch. $plant^{-1}$).

NPK Nano Fertilizer Concentrations	ntrations Humic acid conce			Fertilization rate
	H0	H1	H2	
N0	10.67	13.67	11.33	11.89
N1	14.33	9.67	11.67	11.89
N2	13.67	12.67	18.00	14.78
Humic acid level	12.89	12.00	13.66	
	LSD $_{0.05}$			
N=0.001		H= NS		N*H=0.001

2.3. Increase in the Diameter of the Stem (cm)

Table (4) showed that the average stem diameter was not significantly affected when the compound Nano-fertlizer and humic acid

were treated. The interaction did not give significant differences between Nano-fertilizer and humic acid treatments in the character of stem diameter.

Table 4. The effect of NPK Nano-fertilizer, humic acid and the inte raction betwen them on stem diameter (cm) for olive seedlings.

NPK Nano Fertilizer Concentrations	Humic acid concentration			Fertilization rate
	H0	H1	H2	
N0	4.67	6.00	6.67	5.78
N1	6.33	5.67	5.33	5.77
N2	5.00	7.67	6.33	6.33
Humic acid level	5.33	6.44	6.11	
		$LSD_{0.05}$		
N= NS		H=NS		N*H=ns

2.4. Increase in Leaves Number (leaf. plant^{-1})

The result of Table (5) showed that the effect of the Nano-fertilizer on the rate of increase in leaves number was significant, N2 level recorded the highest average at 77,176 leaves. plant^{-1}, compared to treatment of N1, which gave 129.11 leaves. plant^{-1} in a row, all out performed the control treat ment that gave the low mean value. 117.11 leaves. plant^{-1}.

Humic acid had a significant effect on leaf numbers; the H2 treatment gave 144.78 cm, superior to the H1 treatment, which gave 130.99 leaves. plant^{-1}, as well as the control treatment, gave 147.22 leaves. plant^{-1}.

The results listed in the Table showed that the interaction had a significant effect and the treatment of N2H2, which amounted to 187.67 leaves. plant^{-1} outperformed the treatment of N1H1, which gave the lowest value for trait, 108.33 leaves. plant^{-1}.

Table 5. The effect of NPK Nano-fertilizer, humac acid and the interaction between them on leaves number (branches. Plant^{-1}) of olive seedlings.

NPK Nano Fertilizer Concentrations	concentrations Humic acid			Fertilization rate
	H0	H1	H2	
N0	112.33	108.33	130.67	117.11
N1	165.00	106.33	116.00	129.11
N2	164.33	178.33	187.67	176.77
Humic acid level	147.22	130.99	144.78	
		$LSD_{0.05}$		
N=0.001		H=0.001		N*H=0.001

2.5. Increase in Leaf Area (cm^2)

The results of Table (6) showed that the effect of Nano-fertilzer on the rate of incrase in leaf area was significant; level N2 recorded the highest average at 22.5 cm^2 compared to level N1, which gave 4.89 cm^2 in a row, which was all of outperformed the control treatment that gave the lowest average of 3.66 cm^2.

As for the humic acid, its effect was not significant. The results listed in the Table showed that the interaction has a significant impact. The treatment N_2H_2, which amuonted to 6.67 cm^2, outperformed the control treatment, and the treatment N_0H_2, which gave the low value for this trait, 3.33 cm^2.

Table 6. The effect of NPK Nano-fertilizer, humic acid and the interaction between them on leaf area (cm^2) for olive seedlings.

NPK er Nano Fertiliz Concentrations	Humic acid concentrations			Fertilization rate
	H0	H1	H2	
N0	3.33	4.33	3.33	3.66
N1	4.67	5.67	4.33	4.89
N2	5.33	3.67	6.67	5.22
Humic acid level	4.44	4.55	4.77	

	LSD $_{0.05}$	
N=0.001	H=ns	N*H=0.001

2.6. Total Chlorophyll Content of Leaves (mg.g^{-1} fresh weight)

It is clear from the results shown in Table (7) that the addition of NPK Nano-fertilizer had a significant effect on the chlorophyll content of leaves, as the N2 addition level was significantly superior to the N1 addition, and the control treatment by giving it the highest leaf content of chlorophyll which was 65.43 mg.gm^{-1} fresh weight. As for the effect of humic acid, the results showed significant superiority of H2 level over the other two levels. It gave the highest chlorophyll content in the leaves, which reached 65.30 mg.gm^{-1} fresh weight.

The two interactions (addition of NPK Nano-fertilizer and humic acid) showed a significant positive behavior. The interaction (N2H2) outperformed the rest of the interactions, the leaves content of chlorophyll was 66.30 mg.g^{-1} fresh weight. In contrast, the interaction treatment N0H0 gave the lowest content of chlorophyll leaves and was 62.15 mg .gm^{-1} fresh weight.

Table 7. The effect of NPK Nano-fertilizer, humic acid and the interaction between them on Total chlorophyll content of leaves (mg.g^{-1} fresh weight) of olive seedlings.

NPK Nano Fertilizer Concentrations	Humic acid concentrations			Fertilization rate
	H0	H1	H2	
N0	62.15	63.49	64.91	63.50
N1	63.75	64.72	64.71	64.39
N2	64.35	65.64	66.30	65.43
Humic acid level	63.41	64.61	65.30	
	LSD $_{0.05}$			
N=0.015	H=0.014		N*H=0.025	

2.7. Discussing the Effect of NPK Nano-Fertilizer, Humic Acid and the Interaction Between them on some Vegetative Characteristics

This explains that the Nano-fertilizer increases the efficiency of the plant in absorbing water and nutrients and that macro-nutrients have an active role in the various metabolic processes in the plant and then increase the growth, which is positively reflected in the activity of the vegetative group, which leads to an increase in the characteristics of the vegetative group as a result of the expansion of cells by Growth hormones, and this leads to an increase in the number of branches and an increase in their length, and consequently an increase in the number of branches, the number of leaves and the leaf area, and this, in turn, is reflected on the rest of the results. These results agreed with [14].

These increases in some characteristics with the increase in the level of compound fertilizer may be attributed to an increase in the availability of elements in the soil and an increase in their absorption by the seedlings through the root. These elements are necessary and important in the groups of bioferrins that enter into the synthesis of photosynthesis, which are involved in the chorophyll and are important in the plastids, which encourage the growth of leaves. And other vegetative organs [15], found on rosmary.As for the increase in the number of leaves, this is also due to the role of humic acid in encouraging cell division and increasing their number, which is reflected in an increase in the plant's vegetative growth and thus an increase in the number of leaves. Organic matter has an important role in improving the chemical and physical properties of the soil and increasing the activity of microorganisms in it, which increases the readiness of nutrients in it, which leads to increased plant growth [16]. On increasing the vegetative growth characteristics of plants by increasing the formation of proteins, nucleic acids and protoplasmic structures through the construction of RNA and DNA necessary for cell division and its role in carbon metabolism, respiration and energy provision. Consistent with the necessity for the formation of new cells, which increases plant growth [17].

As for the significant superiority in the concentration of chlorophyll,. Humic acid in the soil increases the rates of nitrogen liberated in the soil, which increases the accumulation of nitrogen in the plant, improving the physical and chemical properties of the soil and then increasing the content of leaves from chlorophyll [18].

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