

Effect of organic and NPK fertilizers on some chemical traits of seedlings of two olive cultivars *Olea europaea* L

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Abstract

This study was conducted in lathhouse at the Agricultural Research and Experiment Station of the College of Agriculture - University of Kirkuk during the period from (1/10/2020 - 1/6/2021). To study the response of seedlings of two olive cultivars, *Olea europaea* L., to some organic and NPK fertilizers, the experiment was applied according to the design of Randomized Complete Block Designs with three replications within the factorial experiments and with two factors: the first factor is the cultivars (Nepali and Manzanillo), and the second factor is the addition of different levels of mineral and organic fertilizers (Distilled water only (control treatment), (500 mg/L of NPK), (750 mg/L of (NPK), (80 mg/L of Biogreen), (120 mg/L of (Biogreen), (500 mg/L of Biogreen) and (500 mg/L of Biogreen). Naturwin, 1000 mg/L of Naturwin, 500 mg/L of Total Humic, 1000 mg/L of Total Humic, The results obtained can be summarized as follows: The Nepali variety was the best for its superiority in most of the traits, namely, the percentage of nitrogen in the leaves and the percentage of potassium in the leaves were (2.33) and (2.27) %, respectively. Spraying 750 mg/L of NPK mineral fertilizer led to a significantly excelled on the rest of the treatments. The percentage of nitrogen in the leaves, the percentage of phosphorous in the leaves, the percentage of potassium in the leaves, the percentage of protein in the leaves and the percentage of carbohydrates in the leaves reached (3.15) and (1.63) %, (3.15) %, (7.70) % and (8.58) %, respectively, The treatment (1000 mg/L Total Humic) excelled in the traits of increase in plant height, increase in the number of leaves, and chlorophyll content in leaves reached (8.20) cm and (13.60) leaves/seedling and (60.60) mg/100 gm. The bi-interaction between the cultivars and the organic and mineral fertilizer was more than the interaction between 750 mg/l of NPK with the cultivar Nepali in most of the traits, which is the percentage of nitrogen in the leaves The percentage of phosphorous in the leaves, the percentage of potassium in the leaves, the percentage of protein in the leaves, and the percentage of carbohydrates in the leaves were (3.66%), (1.80%), (3.66%), (7.70)% and (9.60)%, respectively.

Key words: organic fertilizers, NPK mineral fertilizer, olives.

Introduction

Olive (*Olea europaea* L.) belongs to the Oleaceae family and is considered one of the most important and most widespread trees in the Arab world due to the economic and social importance of these countries, so it is necessary to pay attention to this tree and take care of it, which contributes to increasing production, In addition, olives are a major source of many important elements, as the olive fruit is characterized by a high nutritional value, as it is rich in carbohydrates (5.5%), proteins (1.6%), nutrients (1.5%), and oil from (15-21)% (6). Currently, olive cultivation occupies a prominent position at the global level, and interest in it is increasing

in line with the importance of olive oil as an important food and gives edible fruits that include (29) genus, and it has great importance in Iraq, especially as it is one of the olive-producing countries (1). The Mediterranean and the neighboring regions, including Iraq, are the original home of olives and constitute approximately 90% of the cultivated areas. According to the International Olive Council for the year 2020, the global production of olive oil is estimated at more than three million and 200 thousand tons. Spain comes first in the list of the top 10 olive oil producing countries in the world, Italy occupies second place, then Tunisia comes in third place, Greece occupies fourth place in the world, and

Morocco occupies fifth place in the world, followed by Turkey in sixth place,) 3) , As for Iraq, the cultivated area has reached (4812) hectares of olive trees. The number of fruitful olive trees in Iraq is estimated at approximately (1063,570) trees, and their production is about (24136) tons, and the average production per tree is about (22.7) kg (4). Chemical fertilizers are necessary for feeding seedlings and fruit trees, as nitrogen is the main component of protein formation, which is mainly involved in the formation of protoplasm, as well as in the formation of amino acids, lecithin, chlorophyll and plant hormones. Nitrogen works to increase the strength of the plant and increase productivity in quantity and quality, and its deficiency leads to poor growth and fading of the color of its leaves. Phosphorous is the key to growth, which leads to an increase in the strength of trees, an increase in the number of fruitful branches and the provision of adequate food for them, due to its importance in the process of photosynthesis and its entry into the bioenergy compounds in the plant. It also leads to an increase in carbohydrates in fruits and thus accelerates ripening (2), and potassium is important in plant nutrition, an activator of enzymes and carbohydrate formation, and is a productive factor as it works to increase sugars (6) Olive trees are characterized by their slow growth compared to other fruit trees, which requires attention to their nutrition in order to encourage them to grow, including spraying with organic fertilizers, which ensures the provision of many important nutrients. Which plays an important role in improving the vegetative and root characteristics through the nutrients necessary for their growth, which are included in the formation of enzymes and important amino acids by increasing vegetative growth and the emergence of chlorophyll, which is one of the processes necessary for photosynthesis, which increases processed carbohydrates and increases growth rates in trees. 1) .The organic matter also affects the

growth of olive trees through its effect on the processes of photosynthesis and respiration. It plays an important role in improving the properties of the soil, as well as being a storehouse for many important nutrients for the plant, in addition to its role in maintaining the soil, and this leads to improving the strength of plant growth and reducing high costs and the residual effect of nitrates and nitrites that are harmful to human, animal and plant health (13) , Given the importance of organic and mineral fertilizers on olive seedlings and the lack of studies in the region, the study aimed to: Study the effect of spraying with organic fertilizers (Naturwin, Total Humic and Biogreen), and the effect of spraying with NPK-neutral mineral fertilizer and finding the best overlapping combination between the two cultivars and the studied factors in improving the properties of mineral content.

Materials and methods

experiment location:

This study was conducted in lathhouse at the Agricultural Research and Experiment Station of the College of Agriculture - University of Kirkuk during the period (1/10/2020 - 1/6/2021) to study the response of seedlings of two olive cultivars to some organic and NPK fertilizers. Olive seedlings were obtained from Al- Hawija Horticulture Planting Station of the General Directorate of Horticulture and Forests - Ministry of Agriculture at the age of one year, homogeneous in age and growth, knowing that the study seedlings were planted in polyethylene bags of black color, 30 cm high, 3 kg in size and 15 cm in diameter.

Soil Analysis:

Samples were taken from the soil planted with the study seedlings, and the soil was analyzed in the laboratories of the Kirkuk Agriculture Directorate to measure some chemical and physical characteristics (Table 1).

Table (1) Some physical and chemical properties of field soil.

values	analyses result	Analysis name	No.
	62	sand	1-
	25	clay	2-
	13	silt	3-
Sandy loam		soil texture	4-
	7.12	pH	5-
g.KG ⁻¹ %	2.5	Organic matter	6-
mg.KG ⁻¹	1.32	total nitrogen	7-
mg.KG ⁻¹	11.4	Available phosphorus	8-
mg.KG ⁻¹	33.2	soluble potassium	9-
dS.m ⁻¹	0.34	electrical conductivity	10-

Experiment design:

The design used to implement the experiment is the design of randomized complete blocks within the R.C.B.D (Randomized Complete Block Design) factorial experiments, and the experiment includes two factors: (different concentrations of organic and mineral fertilizers x two cultivars of olives), As the number of treatments was (18) treatments were distributed randomly within one replicate, knowing that the experiment included three replicates, and all the experimental units in the experiment included (45) experimental units, and the number of seedlings within the experimental units reached (5) seedlings, where the total number of seedlings reached (270) seedlings with (135) seedlings of each cultivar, the data obtained were statistically analyzed using the computer (according to the SAS system)), and the averages were compared at the level of probability of 5% according to what was mentioned (5).

Experiment treatments:

The first factor / cultivars:

1- The cultivar is Nepali and is symbolized by V1.

2- The cultivar is Manzanillo, symbolized by V2 .

The second factor / organic fertilization with (Biogreen, Naturwin, Total Humic) and mineral fertilization with NPK:

1- Spraying with distilled water only (control treatment) and symbolized by T1.

2- Spraying with a concentration of 500 mg / liter of neutral NPK (20:20:20) and symbolized by T2.

3- Spraying with a concentration of 750 mg/L of neutralized NPK (20:20:20) and symbolized by T3.

4- Spraying at a concentration of 80 mg / liter of Biogreen (seaweed extract) and symbolized by T4.

5- Spraying at a concentration of 120 mg / liter of Biogreen (seaweed extract) and symbolized by T5.

6- Spraying with a concentration of 500 mg / liter of organic fertilizer Naturwin (contains organic matter 45%, amino acids 24%, organic carbon 20% and organic nitrogen 5.5%) and symbolizes T6.

7- Spraying with a concentration of 1000 mg / liter of organic fertilizer Naturwin (contains organic matter 45%, amino acids 24%, organic carbon 20% and organic nitrogen 5.5%) and symbolized by T7.

8- Spraying at a concentration of 500 mg / liter of Total Humic fertilizer (contains 70% humic acid, 10-12% folic acid, K20, ME, FE, Ze 200PPM, B 8PPm) and symbolized by T8.

9- Spraying with a concentration of 1000 mg / liter of Total Humic fertilizer (contains 70% humic acid, 10-12% folic acid, K20, ME, FE, Ze 200PPM, B 8PPm) and symbolized by T9.

Studied traits:

1- Percentage of nitrogen in leaves (%): This trait was estimated by Microkjeldahl device, which was described before (10).

2- Percentage of phosphorous in the leaves (%): It was calculated in the same way mentioned (14) as it was estimated by colorimetric method and reading light absorption with a wavelength of (410) nanometers by means of a spectro photometer of type 1100 - v - Iab - Eme .

3- Percentage of potassium in the leaves (%): This traits was calculated by means of a flame photometer of type 378 - CL Elico, according to the method mentioned (14).

4- Percentage of protein in leaves %:

It was estimated by estimating the nitrogen content in the leaves using the (Micro Khejldal) method, where the leaves were crushed and 0.2 gm of each experimental unit was taken. Then the samples were digested by the wet method using concentrated sulfuric acid and pyrochloric acid in glass flasks of 50

mm capacity. After the digestion process was completed, the protein content was estimated. in the papers and multiplying them by a certain constant as stated in (8), according to the following equation:

Protein percentage = nitrogen content in the plant material x 6.25

5- The percentage of carbohydrates in the leaves %:

The carbohydrates in the leaves were estimated by taking a number of adult leaves from the middle of the branches and in different areas and dried in an electric oven at (65) C° until the weight was stable and then crushed and this characteristic was estimated.

Results and discussion

The percentage of nitrogen in the leaves (%).

From the results shown for the percentage of nitrogen in the leaves in Table (2), there are significant differences between the two cultivars. The Nepali cultivar significantly excelled on the Manzanillo cultivar and gave the highest percentage, which amounted to (2.33)%. While it reached (1.95)% in the cultivar Manzanillo in this trait. The concentration (750 mg/L⁻¹ NPK) showed a significantly excelled with the concentrations of organic and mineral fertilizers, reaching (3.15)% compared with other concentrations. While the control treatment gave the lowest percentage for this trait, which amounted to 1.46%. In the bi-interaction between the two cultivars, organic fertilizers and mineral fertilizers, the interaction between 750 mg/L⁻¹ of NPK with the cultivar Nepali was significantly excelled and gave the highest percentage of (3.66%), Whereas, the lowest percentage in this trait was when the comparison treatment was interaction with the cultivar Menzanillo, which amounted to (1.36)%.

Table (2) Effect of the two cultivars and spraying with organic and mineral fertilizers and the interaction between them on the percentage of nitrogen in leaves (%)

Effect of organic and mineral fertilizer concentrations	cultivars		fertilizer concentrations
	Manzanillo	Nepali	
1.46 c	1.56 cd	1.36 d	control treatment
1.95 c	1.83 cd	2.06 bcd	500 mg/L NPK
3.15 a	2.63 bc	3.66 a	750 mg/L NPK
1.95 c	2.03 bcd	1.86 cd	80 mg/L Biogreen
2.06 c	1.86 cd	2.26 bcd	120 mg/L Biogreen
2.13 bc	1.73 cd	2.53 bc	500 mg/L Naturwin
1.86 c	1.76 cd	1.96 bcd	1000 mg/L Naturwin
1.96 c	1.63 cd	2.30 bcd	500 mg/L Total Humic
2.76 ab	2.53 bc	3.00 ab	1000 mg/L Total Humic
	1.95 b	2.33 a	The average effect of cultivars

The values of the averages followed by the same letter for each of the two cultivars, the concentration and the combinations between them do not differ from each other significantly, and the values that differ from each other are significantly different from each other at 5%.

Percentage of phosphorous in leaves (%).

From the results of the statistical analysis shown in Table (3), it was found that there was no significant increase in the percentage of phosphorous in the leaves between the two

cultivars. Whereas, in the concentrations of organic and mineral fertilizers, significant differences were shown, and the concentration (750 mg/L⁻¹ NPK) gave a significant superiority of (1.63)%. Compared with other concentrations, the concentration of 1000 mg /

L of Naturwin gave the lowest percentage for this trait, which amounted to (0.13)%. The values of the averages followed by the same letter for each of the two cultivars, the concentration and the combinations between them do not differ from each other significantly, and the values that differ from each other are significantly different from each other at 5%. In the interaction between

the two cultivars, organic fertilizers and mineral fertilizers, the interaction between 750 mg/L⁻¹ of NPK with the cultivar Manzanillo was significant and gave the highest percentage (1.80)% compared to the rest of the interactions, while the lowest percentage in this trait was when the interaction between 1000 mg/ L of Naturwin with the cultivar Nepali as it reached (0.10%).

Table (3) Effect of the two cultivars and spraying with organic and mineral fertilizers and the interaction between them on the percentage of phosphorous in leaves (%)

Effect of organic and mineral fertilizer concentrations	cultivars		fertilizer concentrations
	Manzanillo	Nepali	
0.51 cd	0.16 ef	0.86 cde	control treatment
0.46 cd	0.16 ef	0.76 c-f	500 mg/L NPK
1.63 a	1.80 a	1.46 abc	750 mg/L NPK
0.70 bc	0.53 def	0.86 cde	80 mg/L Biogreen
0.90 bc	0.73 def	1.06 bcd	120 mg/L Biogreen
0.70 bc	0.53 def	0.86 cde	500 mg/L Naturwin
0.13 d	0.16 ef	0.10 f	1000 mg/L Naturwin
0.80 bc	0.53 def	1.06 bcd	500 mg/L Total Humic
1.10 b	1.60 ab	0.60 def	1000 mg/L Total Humic
	0.69 A	0.85 a	The average effect of cultivars

The percentage of potassium in the leaves (%).

From the results shown for the percentage of potassium in the leaves in Table (4), there are significant differences between the two cultivars, where the Nepali cultivar significantly excelled on the Manzanillo cultivar and gave the highest percentage, reaching (2.27%), but the Manzanillo cultivar obtained the lowest percentage in this trait, as it reached (1.94) %. The values of the averages followed by the same letter for each of the two cultivars, the concentration and the combinations between them do not differ from each other significantly, and the values that differ from each other are significantly different from each other at 5%. The concentration (750 mg/L⁻¹ NPK) showed a significantly excelled when the concentrations of organic and mineral fertilizers amounted to (3.15)% compared with other concentrations, while the comparison treatment gave the lowest percentage for this trait, which amounted to (1.46)%. In the interaction between the two cultivars and the organic and mineral fertilizers, the interaction between 750 mg/L-1 of NPK with the cultivar Nepali was significant and gave the highest percentage (3.66%), while the lowest percentage was in this trait when the interaction between the control treatment with the cultivar Nepali reached (1.36) %.

Percentage of protein in leaves (%).

From the results shown in Table (5) for the percentage of protein in the leaves, there are significant differences between the two cultivars, as the Nepali cultivar significantly excelled on the Manzanillo cultivar and gave the highest percentage, as it reached (14.56)%, However, the Manzanillo cultivar gave the lowest percentage in this trait, as it reached (12.18)%. While in the concentrations of organic fertilizers and mineral fertilizers, significant differences were shown, and the concentration (750 mg/L⁻¹ NPK) gave a

significant advantage of (19.68)% compared with the other concentrations, and the comparison treatment gave the lowest percentage for this trait amounted to (9.12)%. In the interaction between the two cultivars, organic fertilizers and mineral fertilizers, the interaction between 750 mg/L-1 of NPK with the two cultivars Nepali was significant and gave the highest percentage (22.87%) compared to the rest of the interactions, while the lowest percentage in this trait was when the interaction between the comparison treatment with The cultivar is Nepali (8.5%). The values of the averages followed by the same letter for each of the two cultivars, the concentration and the combinations between them do not differ from each other significantly, and the values that differ from each other are significantly different from each other at 5%.

The percentage of carbohydrates in the leaves (%).

From the results presented in Table (6), it was found that there was no significant increase in the percentage of carbohydrates in the leaves between the two cultivars. While in the concentrations of organic fertilizers and mineral fertilizers, significant differences were shown, and the concentration (750 mg/L-1 NPK) gave a significant superiority, reaching (8.58)% compared with other concentrations, and the control treatment gave the lowest percentage for this trait, which amounted to (4.58)%. In the bi-interaction between the two cultivars, organic fertilizers and mineral fertilizers, the interaction between 750 mg/L⁻¹ of NPK with the cultivar Nepali was significant and gave the highest percentage of (9.60)% compared to the rest of the interactions, while the lowest percentage in this trait was when the interaction between the control treatment With the cultivar Nepali, with the cultivar Nepali, it reached (3.80%).

Table (4) Effect of the two cultivars and spraying with organic and mineral fertilizers and the interaction between them on the percentage of potassium in leaves (%)

Effect of organic and mineral fertilizer concentrations	cultivars		fertilizer concentrations
	Manzanillo	Nepali	
1.46 c	1.56 cd	1.36 d	control treatment
1.90 c	1.83 cd	1.96 bcd	500 mg/L NPK
3.15 a	2.63 bc	3.66 a	750 mg/L NPK
1.95 c	2.03 bcd	1.86 cd	80 mg/L Biogreen
1.96 c	1.76 cd	2.16 bcd	120 mg/L Biogreen
2.05 bc	1.73 cd	2.36 bcd	500 mg/L Naturwin
1.95 c	1.96 bcd	1.93 cd	1000 mg/L Naturwin
1.90 c	1.63 cd	2.16 bcd	500 mg/L Total Humic
2.68 ab	2.36 bcd	3.00 ab	1000 mg/L Total Humic
	1.94 b	2.27 a	The average effect of cultivars

Table (5) Effect of the two cultivars and spraying with organic and mineral fertilizers and the interaction between them on the percentage of protein in leaves (%)

Effect of organic and mineral fertilizer concentrations	cultivars		fertilizer concentrations
	Manzanillo	Nepali	
9.12 e	9.75 fg	8.5 g	control treatment
12.18 d	11.43 fg	12.87 c-f	500 mg/L NPK
19.68 a	16.43 a	22.87 a	750 mg/L NPK
12.18 bc	12.68 b-e	11.62 a-d	80 mg/L Biogreen
12.87 cd	11.62 c-f	14.12 c-f	120 mg/L Biogreen
13.31 bc	10.81 a-d	15.812 a-d	500 mg/L Naturwin
11.62 cd	11 a-d	12.25 d-g	1000 mg/L Naturwin
12.25 cd	10.18 efg	14.37 a-e	500 mg/L Total Humic
17.25 ab	15.81 abc	18.75 ab	1000 mg/L Total Humic
	12.18 b	14.56 a	The average effect of cultivars

Table (6) Effect of the two cultivars and spraying with organic and mineral fertilizers and the interaction between them on the percentage of carbohydrates in leaves (%)

Effect of organic and mineral fertilizer concentrations	cultivars		fertilizer concentrations
	Manzanillo	Nepali	
4.58 c	5.36 cd	3.80 d	control treatment
4.75 c	4.76 cd	4.73 d	500 mg/L NPK
8.58 a	7.56 abc	9.60 a	750 mg/L NPK
6.05 bc	5.53 cd	6.56 a-d	80 mg/L Biogreen
5.75 bc	5.03 cd	6.46 a-d	120 mg/L Biogreen
5.71 bc	5.56 bcd	5.86 bcd	500 mg/L Naturwin
5.71 bc	5.33 cd	6.10 bcd	1000 mg/L Naturwin
6.41 bc	6.66 a-d	6.16 bcd	500 mg/L Total Humic
7.63 ab	6.43 a-d	8.83 ab	1000 mg/L Total Humic
	5.80 a	6.45 a	The average effect of cultivars

The values of the averages followed by the same letter for each of the two cultivars, the concentration and the combinations between them do not differ from each other significantly, and the values that differ from each other are significantly different from each other at 5%.

Fourth: Discussion:

Effect of the two cultivars on vegetative and root growth traits, mineral content of NPK, protein and carbohydrates. The differences between the two cultivars are due to the anatomical difference between the root systems of plants, as well as their differences in the outputs of the contents of photosynthesis within the plant itself, which are responsible for the different growth factors in the plant (11), and that the Nepali cultivar excelled in most of the studied traits indicates the physiological and genetic differences of these two cultivars and their reflection on the growth of olive seedlings (15), that one of the most important essentials for plants is to find suitable cultivars that are planted in environments with different conditions (12).

Effect of organic and mineral fertilizers on the leaves content of NPK, protein and carbohydrates.

The process of spraying organic and mineral fertilizers leads to an increase in the concentration of elements in the leaves due to an increase in their readiness when spraying, which is reflected on growth, which increases the percentage of absorbed elements due to its activation of the cellular enzyme H-ATPase to cells, and this enzyme increases the absorption and transfer of nutrients (9). Organic and mineral fertilizers contain a large and balanced group of macro and micro nutrients, some enzymes and amino acids that have a role in stimulating physiological processes, activating enzymes in plants and increasing the efficiency of photosynthesis. and then the increase in the manufacture of organic compounds, including carbohydrates, and their transfer to the storage organs, which could be a reason for the increase in the content of the leaves from NPK, proteins and carbohydrates, and the reason for the high percentage is due to the relationship between these two components, as this ratio is the product of the division of what the leaves contain from the elements. The task in which it is stored (16).

conclusions.

1. The Nepali cultivar excelled on the Manzanillo cultivar in most of the chemical properties.
2. The addition of the mineral fertilizer level of 750 mg/L NPK led to a significant increase in most of the traits compared to other fertilization treatments.
3. The addition of the organic fertilizer level of 1000 mg/L Total Humic showed superiority and caused an increase in some characteristics compared to other fertilization treatments.

recommendations.

Emphasis on the cultivar Nepali in subsequent experiments and the use of other concentrations of mineral and organic fertilizers that are most effective in improving the chemical properties of trees and conducting other studies, including them, to know the effect of adding mineral and organic fertilizers on other olive cultivars.

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