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Article

Effect of spraying with nanofertilizer and adding biofertilizers on some chemical traits of two cultivars of olive seedlings

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Abstract: This study was conducted at Al-Zafaraniya Station - Department of Horticulture - Ministry of Agriculture for the spring season 2022, to study the effect of spraying with nano-fertilizer S at three concentrations (0, 1, 2) g.L-1, and adding the biofertilizer F for mycorrhizal fungi and azotobacter bacteria at four levels (0, 50 spores). /g-1 dry soil, 5 ml L-1, 50 spores /g-1 dry soil + 5 ml L-1) on two cultivars of olive seedlings (Ashrasi A1 and Arbequina A2) one year old. A factorial experiment was conducted using a completely randomized block design. (RCBD) and with three factors, and the number of experimental parameters was 24 = 4 x 3 x 2, for three replications, and the experimental unit included 5 seedlings, so the total number of seedlings in the sector becomes 120 seedlings, and the total number of seedlings in the experiment is 360. The data was analyzed according to the statistical program Stat Gen, and the parameters were compared according to L.S.D. at The probability level is 0.05 according to a randomized block design, and the results can be summarized as follows: The cultivars have a significant effect on the chemical traits, where Ashrasi A1 cultivar had a significant effect on the leaves' content of (nitrogen, phosphorus, iron, and zinc), recording (2.01%, 0.39%, 96.78ppm, and 30.86ppm), and excelled on the Arbequina A2 cultivar, which reached the leaves' nutrient content (1.93%, 0.37%, 93.09 ppm and 28.75 ppm) respectively. The nano-fertilizer spraying treatment had a positive effect on all the studied traits, as the S2 spraying treatment at a concentration of 2 g.L-1 excelled, recording the highest averages for all the studied traits (nitrogen, phosphorus, iron, and zinc), which amounted to (2.26%, 0.42%, and 99.32). ppm and 35.25ppm) compared to the no-add treatment, which recorded the lowest average of (1.96%, 0.34%, 91.26 ppm, and 24.52ppm), respectively. It also had a significant increase in the treatment of biofertilizers with mycorrhizal fungi and azotobacter aggregate F3, which were added in an enhanced manner on all the studied traits, which included (nitrogen, phosphorus, iron, and zinc), reaching (2.27%, 0.44%, 101.51 ppm, and 35.06 ppm), respectively. It was found that The bi-interaction treatment of nanofertilizer and S2F3 biofertilizer had a significant effect on the vegetative and root growth traits. The triple interaction treatment of the study factors had a significant effect on all the studied traits, and the triple interaction treatment a1S2F3 was significantly excelled in all the studied traits.

Keywords: nanofertilizer, biofertilizers, olive seedlings

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1. Introduction

The olive tree is an evergreen tree and one of the most important oil crops in the world. Its scientific name is (Olea europaea L.) and is part of Oleaceae family. It is native to the Mediterranean and is characterized by profound economic, social and environmental importance (Agha and Daoud, 1991). The number of olive cultivars has been estimated to exceed About (2629) cultivars, and there are more than (40) of them in Iraq (Genaidy et al., (2015). Due to the large number of cultivars, olive fruits were divided into oleaginous cultivars (for extracting oil) and table cultivars in addition to bi--purpose cultivars. It was also found that the variation in cultivars and The extent to which it is affected by experimental treatments and agricultural operations is due to differences in genetic composition, which is reflected in vegetative, fruitful and productive growth (Al-Khafaji et al., 1990; Therios, 2009; Al-Duri and Adel, 2000). The estimated olive production in Iraq for the year 2022 and for the summer season was 33,912 tons, and the average tree productivity was 33,912 tons. Each one is 25.51 kg, and Anbar Governorate ranked first in terms of production, estimated at about 12.50 tons, followed by Nineveh and Baghdad Governorates, with 91.83 tons and 91.53 tons, respectively (Central Bureau of Statistics, 2022). The olive tree is of economic importance, as its fruits are used as food, as well as its oil It is considered one of the best vegetable oils because it prevents atherosclerosis and treats heart disease (Preedy and Watson, 2010). Nanofertilizers are nutrient carriers with sizes of 1-100 nanometers. When the size is reduced, the surface area increases significantly (Prasad et al., 2012). Nano fertilizer participates in accelerating plant growth by raising the level of the photosynthesis process and increasing plant-produced materials, thus increasing production, improving soil properties, and increasing the structure of elements as a result of improving soil contact surfaces, and this enhances environmental sustainability (Mastronardi and Monreal, 2015, Prasad et al., 2012). As noted by (ALalam and ALalaf, 2020)When added in the form of an element or a group, nanofertilizers work to stimulate and increase vegetative growth, the plant's content of mineral elements, and increase the effectiveness of using nutrients in reducing environmental pollution. Biofertilizers help directly or indirectly in achieving food security, as they represent biological sources that contain different living microorganisms such as bacteria, fungi, or both, as they work to enhance the growth of the root system to increase the ability to absorb water and nutrients. They are distinguished by their ability to release nutrients from Plant residues and raw materials are prepared freely for the plant and promote growth and provide primary nutrients to the host plant (Hari et al., 2010 and Mosa et al., 2014). Biofertilizers contain different types of microorganisms, including fungi that live symbiotically and mutually benefit (such as mycorrhizal fungi), and another type that is free-living in the soil and whose activity increases as a result of plant roots secreting substances that encourage biological activity, such as Ossobacter bacteria, which fix atmospheric nitrogen. Hayat et al., 2010). This study was carried out to determine the effect of nanofertilizers and fungal and bacterial biofertilizers, indivibi-ly or in combination, on the growth of some chemical traits of two types of olive seedlings.

2. Materials and Methods

The experiment was conducted in the canopy of the Saffron farm, Department of Horticulture - Ministry of Agriculture, for the spring season of 2022. To study the effect of spraying nanofertilizers (microelements) and ground treatment with biofertilizers (Mycorrhizal inoculum and Azotobacter inoculum) on some chemical traits of two cultivars of olive seedlings. A factorial experiment was conducted using a randomized complete block design (RCBD) with three factors. The number of experimental parameters was 24 = 4 x 3 x 2, and for three replicates. The experimental unit included 5 seedlings, so the total number of seedlings in replicates becomes 120 seedlings, and the total number of seedlings in the experiment is 360. The data was analyzed according to the statistical program. Gen Stat and the coefficients were compared according to L.S.D at the probability level of 0.05 (Al-Rawi and Khalaf Allah, 2000)

Study factors:

The first factor: Two cultivars of olive seedlings (a local cultivar, Ashrasi, and a Spanish introduced cultivar, Arbequina), one year old, of a size that was as homogeneous as possible, and the cultivars were coded as A2 and A1, respectively.

The second factor: nano-fertilizer (IQCOMBI), which contains some minor elements as shown in Table (1). The nano-fertilizer was added sprayed at three concentrations (2.1.0 g l^{-1}) and four sprays in a season and on dates of 1/3, 20/3, and 10/4. , 4/30 and symbolized by S2,S1,S0.

Table (1) Contents of nanofertilizers (IQCOMBI)

Element	B	Cu	Fe	Mn	Zn
Percentage	0.2%	0.5%	6%	6%	6%

The third factor: Biofertilizers, which were obtained from the Agricultural/Saffron Research Department of the Ministry of Science and Technology, which included four levels: control treatment (without vaccine) and its symbol is F0. The mycorrhizal vaccine, Glomus spp., was prepared at a concentration of 50 spores/gm-1 of dry soil, and was coded as F1. And the chroccomus Azotobacte vaccine was prepared at a concentration of 1×910, and 5 ml.L-1 of liquid was added to each plant, and its symbol was F2. The vaccine interaction between the mycorrhizae was 50 spores/ 1 gm - dry soil + Azotobacter bacteria inoculum 5 ml.L1-) and is symbolized by the symbol F3.

The experiment began on February 18, 2022 for the spring season, and began by transferring all the olive seedlings of the two cultivars (Ashrasi A1 and Arbaquina A2), which were in plastic bags with their soil, into a pot with a capacity of 7 kg. During the transfer, the treatment of biofertilizers was applied at its four levels, as the mycorrhizal fungus added it to the potting soil in the area. In contact with the roots, the potting soil was also injected with azotobacter bacteria in the area surrounding the roots, as well as the interaction treatment according to the method proposed by Gerdmann and Nicolson, 1963 and Matysiak and Falkowski, 2010) and the addition was according to the experimental parameters for each pot, and the pot was completely filled with soil from peat moss and sand in a ratio of 3:1. . The first spraying of the nanofertilizer treatment was carried out in the early morning, on 3/1/2022, with a 2-litre hand sprinkler until the seedlings were completely wet. As for the control treatments, they were sprayed with water only. The seedlings were watered the day before the spraying process to increase the opening of the stomata, and the concentration of solutes in the The leaf cells increased, and the penetration of ions from the spray solution into the leaf cell wall increased (Al-Sahhaf 1989). All agricultural service operations for the seedlings continued in a homogeneous manner for all the seedlings. The soil used was also analyzed by taking a sample to determine the texture of the soil and some chemical and physical properties (Table 2), and readings were taken for the characteristics. Study dated 1/7 and during the first week of July 2022.

Table (2) Some physical and chemical properties of thresher soil

Property	**Value**		**Unit**
PH: degree of soil reaction	7.1		
EC electrical conductivity	1.35		(ms/cm)
Organic matter	8.49		%
Available ions	Available nitrogen		ppm
	NH4	47.6	
	No3	63.2	
	Available potassium	128.9	
	Available Phosphor	13.2	
Soil separators	Sand	793	$g.kg^{-1}$
	clay	184	
	silt	59	
Soil texture	Sandy loam		

Studies traits in the experiment:

1- Percentage of nitrogen

The percentage of nitrogen was calculated using the modified Kjeldahl method and using the Micro Kjeldahl device (Haynes, 1980).

2- The percentage of phosphorus

The percentage of phosphorus was calculated using the soft digestion method using ammonium molybdate and ascorbic acid in a spectrophotometer (Photometer Spectro) at a wavelength of (882) nanometers (Page et al., 1982).

3- Estimation of the elements (iron and zinc) (PPM)

These elements were estimated using an atomic absorption device (Absorption Atomic Spectro Photometer) according to the method provided by (Al-Sahhaf, 1989).

3. Results

Cultivars

The results in Table (3) showed that the cultivars had a significant impact on the percentage of nitrogen, where the Ashrasi a1 cultivar recorded the highest average percentage of nitrogen in the leaves, reaching (2.01%) compared to the Arbequina a2 cultivar, which recorded a percentage of (1.93). The results showed that spraying with nano-fertilizer significantly increased the percentage of nitrogen in the leaves, as it was found that the S2 spray treatment was excelled on the rest of the spray treatments and recorded the highest average for the trait, amounting to (2.26%) compared to control treatment, which recorded the lowest average, amounting to (1.69%). The addition treatment with biofertilizer had a significant effect on the percentage of nitrogen, if it was observed that the addition treatment F3 was excelled on the rest of the addition treatments and recorded the highest average of (2.27%) compared to control treatment F0 which amounted to (1.68%). It is noted in Table (3) that the bi-interaction treatment between the cultivar and spraying with nano-fertilizer led to a significant effect on the percentage of nitrogen in the leaves, so that the a1S2 treatment significantly excelled and gave its highest value of (2.39%) compared to the a1S0 treatment, which recorded the lowest average. It reached (1.68%) for the first growing season. It was found that the bi- interaction treatment of the cultivar and the biofertilizer had a significant effect on the percentage of nitrogen in the leaves, as it was found to be excelled on the a1F3 treatment, recording the highest average for the trait, amounting to (2.41%) compared to the a1F0 treatment, which recorded (1.68%). As for bi- interaction treatment between nanofertilizer and biofertilizer, it had a significant effect on this trait, where the S2F3 treatment was significantly excelled and recorded the highest average for the trait, amounting to (2.64%) compared to bi-interaction treatment, S0F0, which recorded the lowest average, amounting to (1.45%). The results in Table (3) indicated that the triple interaction treatment had a significant effect on the percentage of nitrogen in the leaves. It was found that the a1S2F3 treatment outperformed and increased the average of the trait, reaching (2.97%) compared to the a2S0F0 treatment, which recorded the lowest average of the trait, amounting to (1.43%).

Table (3) Effect of cultivar, nano and biofertilizer on leaf nitrogen %

average a * S	Biofertilizers (F)				Nano fertilizer S	cultivars A
	F3	F2	F1	F0		
1.68	1.96	1.77	1.54	1.46	S0	a1
1.96	2.31	1.96	1.85	1.71	S1	
2.39	2.97	2.42	2.29	1.87	S2	
1.70	1.88	1.81	1.69	1.43	S0	a2
1.95	2.17	1.98	1.92	1.74	S1	
2.13	2.31	2.22	2.11	1.89	S2	
0.079	0.158				LSD*0.05*	
a * F						
2.01	2.41	2.05	1.90	1.68	a1	
1.93	2.12	2.00	1.90	1.69	a2	
0.046	0.091				LSD*0.05*	
S * F						
1.69	1.92	1.79	1.62	1.45	S0	
1.95	2.24	1.97	1.89	1.72	S1	
2.26	2.64	2.32	2.20	1.88	S2	
0.056	0.112				LSD*0.05*	
	2.27	2.03	1.90	1.68	average F	
	0.065				LSD*0.05*	

The percentage of phosphorus in the leaves

Looking at Table (4), it was found that the cultivars had a significant effect on the percentage of phosphorus, if the Ashrasi a1 cultivar excelled, recording the highest average for the trait, which amounted to (0.39%), compared to the Arbequina a2 cultivar, which recorded an average for the trait, which amounted to (0.37%). The results also confirmed that spraying with nano-fertilizer had a significant effect on the character of the percentage of phosphorus in the leaves, as it was found that the spray treatment S2 was excelled on the rest of the spray treatments and recorded the highest average for the trait amounting to (0.42%) compared to control treatment S0 which recorded the lowest average of (0.34). %). It was found that the addition treatment with biofertilizer had a significant effect on the percentage of phosphorus in the leaves. The F3 treatment was found to be excelled on the rest of the addition treatments and recorded the highest average for the trait, amounting to (0.44%) compared to control treatment, which recorded the lowest average, amounting to (0.32%). The results indicated that bi-interaction treatment of the cultivar and the nanofertilizer had a significant effect on the percentage of phosphorus in the leaves, as the a1S2 treatment excelled, recording the highest average for the trait (0.42%) compared to the a2S0 treatment, which recorded the lowest average (0.32%). In addition, it was found that bi-interaction treatment between the cultivar and the biofertilizer led to a significant effect on the trait, as the a1F3 treatment excelled and recorded its highest value of (0.46%) compared to the a2F0 treatment, which recorded the lowest average of (0.31%). In addition to what was mentioned above, the bi- interaction treatment between the nanofertilizer and the biofertilizer led to a noticeable significant effect on the percentage of phosphorus in the leaves, where the S2F3 treatment excelled and recorded the highest average for the trait (0.49%) compared to the S0F0 treatment, which recorded the lowest average. (0.27%). As for the triple interaction treatment, it significantly affected the percentage of phosphorus in the leaves, where the triple interaction treatment a1S2F3 excelled, recording the highest average for the trait, which amounted to (0.51%) compared to the triple interaction treatment, a2S0F0, which recorded the lowest average, amounting to (0.26%).

Table (4) Effect of cultivar, nano and biofertilizer on leaf phosphorus%

average a * S	Biofertilizers (F)				Nano fertilizer S	cultivars A
	F3	F2	F1	F0		
0.36	0.42	0.34	0.38	0.28	S0	a1
0.40	0.45	0.39	0.42	0.33	S1	
0.42	0.51	0.39	0.42	0.36	S2	
0.32	0.38	0.31	0.35	0.26	S0	a2
0.37	0.40	0.37	0.39	0.31	S1	
0.41	0.46	0.40	0.43	0.35	S2	
0.009	0.018				LSD*0.05*	
a * F						
0.39	0.46	0.37	0.41	0.32	a1	
0.37	0.41	0.36	0.39	0.31	a2	
0.005	0.011				LSD*0.05*	
S * F						
0.34	0.40	0.33	0.37	0.27	S0	
0.38	0.43	0.38	0.41	0.32	S1	
0.42	0.49	0.40	0.43	0.35	S2	
0.006	0.013				LSD*0.05*	
	0.44	0.37	0.40	0.32	average F	
	0.008				LSD*0.05*	

Iron content of leaves (ppm)

The results shown in Table (5) showed that the cultivars had a significant effect on the iron content of the leaves, as the Ashrasi a1 cultivar was significantly superior, recording the highest average for the trait, reaching (96.78) ppm, compared to the Arbequina a2 cultivar, which recorded an average for the trait (93.09) ppm. The results indicated that spraying with nano-fertilizer had a significant effect on the iron content of the leaves, with the S2 spray treatment excelled on the rest of the spray treatments and recorded the highest average for the trait, amounting to (99.32) ppm compared to control treatment, which recorded the lowest average, amounting to (91.26) ppm. It was noted in Table (5) that the addition treatment with biofertilizer had a significant effect on the iron content of the leaves, where the F3 treatment outperformed the rest of the addition treatments, recording the highest average for the trait, amounting to (101.51) ppm, compared to control treatment, F0, which recorded the lowest average, amounting to (87.57). ppm. As for bi-interaction treatment of the cultivar and the nanofertilizer, it had a significant effect on the iron content of the leaves, as bi-interaction treatment a1S2 excelled, recording the highest average of (102.43) ppm compared to bi-interaction treatment a1S2, which recorded the lowest average of (90.53) ppm.

Table (5) Effect of cultivar, nano and biofertilizer on Iron content in leaves

average a * S	Biofertilizers (F)				Nano fertilizer S	cultivars A
	F3	F2	F1	F0		
92.00	97.00	91.01	94.00	85.98	S0	a1
95.92	103.00	95.33	97.00	88.33	S1	
102.43	112.67	100.33	104.03	92.67	S2	
90.53	97.00	89.01	92.00	84.10	S0	a2
92.54	97.83	91.33	94.33	86.67	S1	
96.21	101.53	96.67	98.98	87.67	S2	
1.263	2.528				LSD*0.05*	
a * F						

96.78	104.22	95.56	98.34	88.99	a1
93.09	98.79	92.34	95.11	86.14	a2
0.729	1.459				LSD*0.05*
S * F					
91.26	97.00	90.01	93.00	85.04	S0
94.23	100.42	93.33	95.67	87.50	S1
99.32	107.10	98.50	101.51	90.17	S2
0.893	1.786				LSD*0.05*
	101.51	93.95	96.73	87.57	average F
	1.031				LSD*0.05*

It was also found that bi-interaction treatment of the cultivar and the biofertilizer had a significant effect on the iron content of the leaves, as bi-interaction treatment a1F3 had the highest average for the trait, reaching (104.22) ppm, compared to bi-interaction treatment a2F0, which recorded the lowest average, reaching (86.14) ppm. It was noted in Table (5) that the bi- interaction treatment of nanofertilizer and biofertilizer had a significant effect on the iron content of the leaves. The S2F3 bi- interaction treatment excelled, recording the highest average of (107.10) ppm compared to the S0F0 treatment, which recorded the lowest average of the trait, amounting to (85.04) ppm. The results also showed that the triple interaction treatment between the cultivar and spraying with nanofertilizer and biofertilizer had a significant effect on the iron content of the leaves, as the a1S2F3 treatment recorded the highest average for the trait, amounting to (112.67) ppm, compared to the a2S0F0 treatment, which recorded the lowest average, amounting to (84.10) ppm.

4 - Zinc content of leaves (PPM)

The results in Table (6) indicated that the cultivars had a significant effect on the zinc content of the leaves, as it was found that the Ashrasi A1 cultivar outperformed and gave the highest average for the trait, amounting to (30.86) ppm, compared to Arbequina cultivar, which had an average zinc content in the leaves (28.75) ppm. The results in Table (6) confirmed that the zinc content of the leaves was significantly affected by spraying with nano-fertilizer, as it was found that the S2 spray treatment was excelled on the rest of the spray treatments and recorded the highest average for the trait, amounting to (35.25) ppm compared to control treatment S0, which recorded the lowest average, amounting to (24.52). ppm. It was also found in the same table that treating olive seedlings with biofertilizer led to a significant effect on the zinc content of the leaves, as the F3 treatment outperformed the rest of the addition treatments and recorded the highest average of (35.06) ppm compared to control treatment F0, which recorded the lowest average of (23.94). ppm. It was found that bi-interaction treatment of the cultivar and the nanofertilizer had a significant effect on the zinc content of the leaves, as bi-interaction treatment a1S2 excelled, recording the highest average of (36.93) ppm compared to the a2S0 treatment, which recorded the lowest average of (24.03) ppm. It was also found that bi-interaction treatment of the cultivar and the biofertilizer had a significant effect on the zinc content of the leaves, as bi-interaction treatment a1F3 excelled, recording the highest average (36.11) ppm compared to bi-interaction treatment a2F0, which recorded the lowest average for the trait, reaching (23.22) ppm.

Table (6) Effect of cultivar, nano and biofertilizer on zinc content in leaves

average a * S	**Biofertilizers (F)**				**Nano fertilizer S**	**cultivars A**
	F3	**F2**	**F1**	**F0**		
25.00	29.67	24.33	26.00	20.00	S0	a1
30.67	35.67	29.33	32.33	25.33	S1	
36.93	43.00	36.67	39.37	28.67	S2	
24.03	27.37	24.00	25.43	19.33	S0	a2

28.65	33.00	28.33	29.93	23.33	S1	
33.57	41.67	31.33	34.27	27.00	S2	
1.047	2.094				LSD*0.05*	
a * F						
30.86	36.11	30.11	32.57	24.67	a1	
28.75	34.01	27.89	29.88	23.22	a2	
0.604	1.209				LSD*0.05*	
S * F						
24.52	28.52	24.17	25.72	19.67	S0	
29.66	34.33	28.83	31.13	24.33	S1	
35.25	42.33	34.00	36.82	27.83	S2	
0.740	1.480				LSD*0.05*	
	35.06	29.00	31.22	23.94	average F	
	0.855				LSD*0.05*	

Table (6) indicated that the zinc content of the leaves increased significantly as a result of the bi- intervention treatment of nanofertilizer and biofertilizer, where bi-interaction treatment S2F3 excelled, recording the highest average of (42.33) ppm compared to bi-interaction treatment of S0F0, which recorded the lowest average of (19.67). ppm. In addition to what was mentioned above, the triple interaction treatment had a significant effect on the zinc content of the leaves, as the triple interaction treatment a1S2F3 excelled, recording the highest average for the trait, which amounted to (43.00) ppm, compared to the triple interaction treatment, a2S0F0, which recorded the lowest average for the trait, which amounted to (19.33) ppm.

4. Discussion

The results were shown in Tables (3-6) during the spring growing season of 2022, which indicated that the cultivars and their interaction with the study factors had a significant effect on the chemical characteristics. It was found that the Ashras A1 cultivar had a significant impact and superiority to the Arbequina A2 cultivar in the leaves' content of elements, which included (nitrogen and phosphorus). Iron and zinc), and the reason for the differences in the responses of cultivars to the added treatments of nanofertilizer and biofertilizer may be due to the genetic structures and factors controlling the cultivar, as each cultivar is controlled by a set of genetic genes that differ in their nature and the extent of their interaction with the surrounding environmental conditions (Therios, 2009). This agreed with what was found by (Al-Ishaqi, 2002) when he studied seven cultivars of olives. He agreed with (Flih et al., 2018). The results also showed that the spraying treatment with nanofertilizer and biofertilizer and the interaction between them had a positive effect on all the studied traits. Perhaps the reason may be that nanofertilizers have unique properties due to their small size and large surface area, which leads to an increase in the absorption surface and then an increase in the process of photosynthesis and thus an increase in plant production (Singh and Prasad, 2016). Also, the increase in the leaf content of some macro- and micro-nutrients (Zn, Fe, P, N) may be due to the effect of the elements present in the fertilizer combination, which included (B, Mn, Cu, Zn, Fe), which play an important role in the absorption, removal and accumulation of ions. They quickly move into plant cells, as they do so through the energy they generate for such processes. These elements work to stimulate the enzymes involved in the process of photosynthesis and respiration, and this in turn raises the efficiency and increases the growth of the shoot and root system, increasing the absorption of elements to meet the plant's need for elements and creating Balance the vital processes within the plant, and also leads to the accumulation of these elements in the leaves (Al-Alaf, 2019).

The concentration of nitrogen and phosphorus in the plant leaves increased as a result of increased withdrawal through the root system, and this agreed with (Al-Taie, 2020). When spraying orange seedlings with nanofertiliser, the concentration (2 gm L-1) had a significant impact on the leaves' content of nutrients, which included: (Mn,Fe,P,N), as their average characteristics reached (2.10%, 0.32%, 236.00 mg.kg-1, 16.53 mg.kg-1) respectively compared to control treatment (1.78%, 0.2%, and 218.17 mg. .kg1-, 13.55 mg.kg1-). Perhaps the increase in the concentration of elements (Zn, Fe, K, P, N) in the plant leaves is due to the stimulating effect of the biofertilizer on growth factors, as the inoculation of plants with mycorrhizal fungi positively affects the growth and yield of these inoculated plants due to their ability to absorb phosphorus in a sufficient manner. It has a significant impact on the environment surrounding the roots by secreting organic compounds that dissolve complex compounds and secreting enzymes such as phosphatase, which increases the solubility of phosphate and makes it more systemic for absorption (Soha and Rabie, 2014, Hussain et al., 2015). In addition to its ability to produce secondary compounds that increase the formation of growth regulators such as (gibberellins, auxins, and cytokinins), which are secreted in the rhizosphere, they move into the plant tissues and work to enhance and raise the growth of root hairs, thus increasing the surface area of the roots to absorb nutrients. This is based on the symbiotic relationship between the mycorrhizal fungi. and plants (Hamdan, 2011 and Siddiqui et al. 2006). This agreed with (Newad, 2014) when it was found that local orange trees (C.Sinensis) when inoculated with mycorrhizal fungi had a significant effect on (the leaf content of elements such as nitrogen, phosphorus, potassium, magnesium, calcium, iron, manganese, and zinc) compared to the control treatment. He agreed with (Ali, 2016). The reason for the increased concentration of elements (N, P, Zn, Fe) may also be due to the role of azotobacter bacteria present in the added biofertilizer blend, which plays an effective role in stabilizing the nitrogen element that enters into photosynthesis reactions, forming energy compounds, and building chlorophyll, carbohydrates, and protein, which increases It increases the plant's growth rate, vegetatively and radically, and increases the plant's efficiency in absorbing elements. Azotobacter bacteria also provide some nutrients such as carbon, phosphorus, nitrogen, and sulfur by accelerating the mineralization of organic residues in the soil while avoiding the absorption of various heavy metals (Sharma et al., 2007; Joshi et al., 2006). This agreed with (Maksaud et al., 2012 and Al-Taie, 2020)

5. Conclusion

The study revealed significant findings regarding the effect of nanofertilizer and biofertilizer on the chemical traits of two olive cultivars, Ashrasi and Arbequina. The results demonstrated that Ashrasi had superior nutrient content compared to Arbequina, particularly in terms of nitrogen, phosphorus, iron, and zinc. The application of nanofertilizer at a concentration of 2 g.L-1 significantly enhanced these traits, indicating its effectiveness in improving nutrient absorption and overall plant health. Similarly, the use of biofertilizers, especially the combination of mycorrhizal fungi and azotobacter bacteria, further amplified these positive effects. The interaction between nanofertilizer and biofertilizer showed a synergistic impact, leading to the highest nutrient levels observed in the study. These findings suggest that the combined use of nanofertilizers and biofertilizers can substantially improve the nutritional status and growth of olive seedlings. Future research should explore the long-term effects of these treatments on olive productivity and assess their economic feasibility for large-scale agricultural practices.

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