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RESPONSE OF THE OLIVE SEEDLINGS OF MANZINILLO VARIETY TO FOLIAR SPRAY WITH SOME GROWTH STIMULI

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ABSTRACT

A study was carried out in the lath house at Horticulture and Landscape Department, College of Agriculture and Forestry, University of Mosul during the 2020 growing season. The aim was to demonstrate the importance of foliar spraying with three levels for each of the Nano iron chelate (15, 30 and 45 mg. L^{-1}), liquid organic fertilizer (Compo) (2, 4, and 6 ml. 1 $liter^{-1}$) and seaweed extract fertilizer (Alga600) (5, 10 and 15 g. 1 $liter^{-1}$) in improving vegetative growth and mineral content of olive seedlings variety "Manzanillo. The comparison treatment consisted of spraying with distilled water only." The most important results obtained showed the significant superiority of the treatment of foliar spray with liquid organic fertilizer (Compo) in most of the studied characteristics. This was particularly obvious in the spraying treatment with a concentration of 6 ml. 1^{-1}. This recorded a significant superiority over the rest of the treatments, especially the comparison treatment, in terms of leaf content of nitrogen, zinc, chlorophyll, carbohydrates, protein, and the increase in seedling height. This was followed by the treatment of foliar spraying with nano iron chelate fertilizer at a concentration of 45 mg. L^{-1} was significantly superior to the comparison treatment with compared with the traits, the iron content of the leaves and the increase in the diameter of the seedlings. There were no significant differences in all the fertilizer treatments, including the comparison treatment compared with the traits, the leaves content of phosphorus and potassium.

Keywords: Nano iron chelate; liquid organic fertilizer; seaweed extract; olive seedlings.

INTRODUCTION

Olea europaea L. seedlings are characterized by slow growth in nurseries compared to other fruit seedlings. This requires their stay for a longer period in the nurseries in order to be ready for cultivation in the sustainable place. Consequently, they need attention and nourishment to encourage

their growth by spraying the foliage with chemical and organic fertilizers that ensure prompt delivery of many essential elements, major and minor, in a form that can be absorbed by the leaves, especially in the early stages of seedling life. This will stimulate the vegetative and root growth of the seedlings [1,2], Foliar fertilization is one of the important fertilization methods that are used in fruit nurseries. This is because it achieves the treatment of the nutrient deficiency that fruit seedlings suffer from in a short time. In addition, this method does not transform the elements into a non-absorbable form as if they were added to the soil in addition to using rates Less than fertilizers while ensuring uniform distribution [3].

Nanofertilizers can be added in the form of an element or group of elements, leading to an increase in vegetative growth, plant content of mineral elements, the quantity and quality of the yield, increase the efficiency of nutrient use and with less environmental pollution [4]. This is because the nutrients are liberated from the nanostructured fertilizer in the form of ions of small size and with a high specific surface area and energy penetrating the wall. The cellular size is less than the cell wall openings, which range from 5-20 nm [5,6]. Foliar spraying with nanofertilizers containing microelements, including iron, leads to direct absorption of nutrients in the upper parts of the plant, especially the leaves, thus leading to improved plant growth [7]. Iron is an important element in feeding fruit seedlings because it plays a mediating and essential role in the formation of chlorophyll, although it is not included in its composition, and it is also included in the formation of plant cytochrome. It therefore plays an essential role in the respiration process of the plant, and in the conversion of nitrogen. Dissolved????? What dissolved?? in the leaves into protein, this protein in turn has great importance in protecting chlorophyll from being destroyed by intense sunlight, as well as its importance in the formation of RNA [8]. Iron can be added to the plant in the form of chelated compounds. These are organic compounds that have the ability to chelate the element with chemical bonds. This make it into a soluble non-ionic form suitable for absorption by the plant, may due to chelation process prevented it to conjugated, by chemical reactions. to an unavailable plant image [9].

Also, organic fertilizers of various kinds, including liquid, constitute an important and basic source of the elements needed by plants, major and minor, as liquid organic fertilizers are one of the best alternatives for the nutrients needed by fruit seedlings. This is because they contain some organic acids such as fulvic and humic acids, amino acids and other materials. These helps in improving the chemical, biological and physical properties of the soil. Its good medium for microorganism activity, cheapness, ease of use and low pollution to the environment and agricultural products are important attributes [10,11]. Report from previous works indicates that adding liquid organic fertilizers, as a spray on the vegetative group of fruit seedlings, contributes to facilitating the movement of mineral elements and cell division. This is due to the ability of these fertilizer molecules to enter the cell stream, making the cell membrane more permeable with a corresponding increase in growth and vegetative characteristics of seedlings [12].

Seaweed extracts are organic products that are used as an organic source in improving the growth and production of horticultural plants. More than 15 million tons are used annually in the agricultural field around the world. Seaweed extracts is used as a biostimulator for physiological functions in plants and in organic agriculture due to their effectiveness as fertilizer for seedlings of fruits. Seaweed extracts contain essential plant nutrients such as nitrogen, phosphorus, potassium, iron, copper, zinc, boron and others [13], as well as because they contain many plant hormones such as auxins, gibberellins, and cytokines [14]. These extracts, when sprayed on the leaves of plants, lead to the stimulation of accelerated growth in the roots, increase the thickness of the stem and the efficiency of photosynthesis, owing to the presence of growth stimulating vitamins and enzymes. These, ultimately, leads to an increase in the vegetative and root growth of the plant [15]. Seaweed extracts is also known to increase plant resistance to drought, heat, water stress and plant protection from aging by strengthening and supporting plant cells. It also enhances plant resistance to many

diseases, especially fungal diseases and nematode infestation [16].

Purpose of the Study

Olive seedlings are characterized by their slow growth, thus requires a long time in the nurseries until they are ready for planting in the orchard. The aim of this study was to use some growth stimuli to improve the vegetative growth of olive seedlings, "Manzanillo" and its content of mineral elements and to determine the best material and the best concentration of it to achieve this.

MATERIALS AND METHODS

The research was carried out in the lath house at Horticulture and Landscape Department , College of Agriculture and Forestry ,The University of Mosul during the 2020 growing season, with the aim of studying the effect of foliar spraying of nano iron chelate, liquid organic fertilizer (Compo) and seaweed extract (Alga 600), in three concentrations, in addition to the comparison treatment, at improving the vegetative growth and mineral content of olive seedlings, " Manzanillo variety". The seedlings were selected at a two-year-old and had homogeneous growth (height 30-40 cm and the diameter of the main stem at a height of 5 cm from the surface of the soil 5-7 mm). They were planted in plastic brackets, of 7 kg filled with mixture of soil. Some of the physical and chemical properties of the soil are shown in Table (1).

The olive seedlings were sprayed with three levels each of nano-iron chelate fertilizer (15, 30 and 45 mg. L^{-1}), liquid organic fertilizer (Compo) (2, 4 and 6 ml. $Liter^{-1}$), containing (52% organic matter and 3% organic nitrogen and 6% potassium in the form of K_2O), and seaweed extract fertilizer (Alga600) (5, 10 and 15 g. $Liters^{-1}$, Table 2). The control treatment spraying with distilled water only. The spraying dates were two, (10/4 and 5/10).

The seedlings were sprayed until complete wetness early in the morning. The diffuser (Tween-20) was used at a concentration of 0.1% to homogeneous the distribution of the solution on the leaves. All service operations were performed, such as irrigation, weeding and pest control. Cultural practices for all seedlings were similar throughout the study duration. In the implementation of the study, the design of complete randomized sectors for global experiments (R.C.B.D) was followed in a simple experiment with three replications and three seedlings per experimental unit, so that the number of seedlings used in the study was 90 seedlings.

Table 1. Physical and chemical properties of field soils

character	Units	
Electrical conductivity	$ds.m^{-1}$	0.595
pH		7.50
Organic matter	$G.kg^{-1}$	9.50
$CaCO_3$	$G.kg^{-1}$	175.00
Bicarbonate	$G.kg^{-1}$	0.195
Sand	$G.kg^{-1}$	247.40
Clay	$G.kg^{-1}$	211.60
Silt	$G.kg^{-1}$	541.00
The tissue		**Nutrient availability**
Total nitrogen	٪	0.0105
Ready phosphorous	$Mg\text{-}kg^{-1}$	16.92
Ready potassium	Mg-kg	133.39

Soil analyzed in the central laboratory / College of Agriculture and Forestry / University of Mosul

Table 2. Components of the seaweed extract (Alga600) fertilizer

N 1.0%	P_2O_5 9%	K_2O 24%
Alganic acid 9%	CaO 1.6%	MgO 0.06%
S 1.5%	Fe 0.3%	Amino acid 4%
	Organic matter 50%	

Study Traits

The following traits were measured during the early growing season in the month of August

1- The total amount of carbohydrates in leaves using [17].
2- Chlorophyll content on leaves? (SPAD unit) Soil Plant Analysis Design, using SPAD digital scale device – 502 meters [18].
3- The concentrations of nutrients in the leaves: (% N) using the Microkjeldahl. Phosphorous% by Spectrophotometer and potassium% according to the method proposed by [19]. Zinc and iron (mg. L^{-1}) using an Atomic Absorption Spectro photometer.
4- The percentage of protein in seedling leaves according to the following equation: protein percentage% = percentage of nitrogen x 6.25.

The results were analyzed statistically using SAS software program (SAS, 2001) and the means were compared using the Duncan polynomial test at a probability of error 0.05.

RESULTS AND DISCUSSION

The results, Table 3, indicate that the treatment of foliar spray with liquid organic fertilizer (Compo) at a concentration of (6 ml. Liter $^{-1}$) had a significant effect in terms of (nitrogen content and zinc content in the leaves) as it gave the highest significant values for them, reaching (2.10% and 49.25 mg. L^{-1}), respectively, compared to the control treatment (untreated seedlings), which gave the lowest significant values for these two characteristics, respectively (1.63% and 32.77 mg.l^{-1}). The results on the table also indicate that there are no significant differences between all fertilizer treatments, while the foliar spraying with chelated nano iron fertilizer, especially (30 and 45 mg. L^{-1}) recorded the highest significant values of iron content in leaves, reaching to (102.98 and 106.96 mg. L^{-1}). Respectively, according to the control treatment, which gave the lowest value.

The reason for the increase in the nitrogen and zinc content of olive seedlings' leaves, resulting from the addition of liquid organic fertilizer (Compo), especially the concentration of (6 ml. l^{-1}), may be due to organic matter that helps the direct absorption of nutrients and the it and increases the permeability of cell membranes, which leads to facilitating the transport of nutrients and thus increasing the efficiency of plants to absorb and accumulate elements, including nitrogen and zinc in the leaves [20]. The readiness of nutrients, such as nitrogen and zinc and their absorption by the roots and towards to the leaves [21]. As for the iron increasing content of the leaves as a result of foliar spraying with levels of nano iron-chelated fertilizer, its resulted of absorption by the leaves. this result agreed with results of many studies that indicated the importance of liquid organic fertilizers for increasing the content of the nutrients leaves such as nitrogen and zinc, [22] in loquat, 2 in Olives, and [23] which found an increase iron content of loquat seedlings.

It is noticed from the results of Table (4) that most of the fertilizer treatments used in this study had a significant effect on the studied traits compared to the comparison treatment. The best of these fertilizer treatments was the foliar spray with liquid organic fertilizer (Compo) at a concentration of 6 ml. $Liters^{-1}$. This gave the highest significant values for the traits (increase in seedling height and leaf content of chlorophyll, carbohydrates and protein) and they reached respectively (26.66 cm, 80.31 SPAD, 42.40% and 13.16%). It was followed by the treatment at a concentration of 45 $ml.liter^{-1}$ of nano iron chelated fertilizer, which recorded higher value. A significant increase in seedlings diameter reached to 2.24 mm, while the control treatment also recorded the lowest significant values, respectively (7.82 cm, 0.61 mm, 58.57 SPAD, 29.40% and 10.20%).

The superiority of the 6 ml L^{-1} foliar spray treatment is significant. characteristics of the increase in seedling height and the leaf content of chlorophyll, carbohydrates and protein may be explained by the fertilizer's containment of organic matter and humic acids, which positively affect the vital processes of the plant such as respiration, photosynthesis, and making of proteins and carbohydrates, which leads to an increase in plant height and improved growth, Also, liquid organic fertilizer has an important

Table 3. The effect of foliar spray with concentrations of chelated nano fertilizer, liquid organic fertilizer (Compo) and seaweed extract fertilizer (Alga600) on nitrogen, phosphorous and potassium content and iron and zinc content in *Olive* seedlings cultivar Manzanello

Treatments	Concentrations	Studied traits				
		N%	P %	K %	Fe ppm	Zn ppm
Control	Zero	1.63 b	0.253 a	1.223 a	75.69 b	32.77 b
Chelated nano iron	15	1.86 ab	0.260 a	1.290 a	83.08 ab	37.80 ab
ML . l^{-1}	30	1.91 ab	0.253 a	1.263 a	102.98 a	37.06 ab
	45	1.89 ab	0.303 a	1.200 a	106.96 a	38.62 ab
Organic fertilizers	2	1.87 ab	0.266 a	1.233 a	92.25 ab	43.91 ab
Compo	4	1.82 ab	0.266 a	1.183 a	88.20 ab	46.03 ab
ML . l^{-1}	6	2.10 a	0.270 a	1.263 a	93.08 ab	49.25 a
Seaweed extract	5	1.82 ab	0.283 a	1.226 a	83.61 ab	44.88 ab
Alga600	10	1.91 ab	0.286 a	1.270 a	84.59 ab	43.64 ab
g. l^{-1}	15	1.91 ab	0.276 a	1.266 a	84.11 ab	44.47 ab

* The mean of the coefficients of interference followed by different letters indicate that there are significant differences between them at the 5% probability level according to the Dunkin Polynomial test

Table 4. The effect of foliar spray with concentrations of nano chelated fertilizer, liquid organic fertilizer (Compo) and seaweed extract fertilizer (Alga600) on the increase in the height and diameter of seedlings and the leaf content of chlorophyll, carbohydrates and protein for olive seedlings cultivar Manzanello

Treatments	Concentrations	Studied traits				
		The increase in the height of seedlings	The increase in the diameter of seedlings	The leaf content of chlorophyll	The leaf content of Carbohydrates	The leaf content of protein
Control	zero	7.82 c	0.61 b	58.57 c	29.40 b	10.20 b
Chelated nano iron	15	17.29 b	1.68 ab	70.25 b	30.45 b	11.64 ab
ML . l^{-1}	30	17.55 ab	1.97 ab	68.74 b	35.10 ab	11.95 ab
	45	18.56 ab	2.24 a	78.28 a	40.96 a	11.85 ab
Organic fertilizers	2	17.59 ab	1.61 ab	69.45 b	37.11 ab	11.70 ab
Compo	4	21.29 ab	1.77 ab	70.10 b	33.69 ab	11.39 ab
ML . l^{-1}	6	26.66 a	1.98 ab	80.31 a	42.40 a	13.16 a
Seaweed extract	5	17.81 ab	1.54 ab	66.86 b	34.95 ab	11.37 ab
Alga600	10	18.51 ab	1.61 ab	66.80 b	35.11 ab	11.95 ab
g. l^{-1}	15	18.23 ab	1.72 ab	67.70 b	33.38 ab	11.97 ab

* The mean of the coefficients of interference followed by different letters indicate that there are significant differences between them at the 5% probability level according to the Dunkin Polynomial test

role in providing nutrients in a balanced manner to the plant and increasing the hormonal activity inside the plant tissues and thus increasing the elongation of cells. This is because organic fertilizer helps to increase the readiness of nutrients and improve the cation exchange and then ease their absorption by the plant and increase their quantity inside it, as well as working on Building a strong root system with high efficiency in absorbing macro and micronutrients, which helps in improving plant growth and thus increasing the amount of carbohydrates and proteins processed in leaves to build plant tissues [24]. In addition, this fertilizer contains nitrogen, which encourages the vegetative growth of plants and strengthens the root group for them. It is also the basic element for the formation of protein that is included in the formation of the cell protoplasm, amino acids and enzymes important in the plant's vital activities. It is also included in building cell membranes, which protein is part of its composition [25], in addition, nitrogen is involved in building nucleic acids, DNA, RNA, energy compounds ATP, NADPH, and $NADPH_2$, as well as a basic part in the formation of the green pigment for photosynthesis (chlorophyll) and giving the plant the green color, and it participates in the synthesis of the Porphyrins groups. Included

in the synthesis of chlorophylls and cytochromes important in photosynthesis and respiration [26].The fertilizer also contains potassium, which has an important role in increasing the efficiency and rate of photosynthesis by activating the work of many enzymes associated with this process and the representation of both proteins and carbohydrates in the plant, as well as its important role in the process of cell division as it works to increase the division of the living cells of the plant. This promotes meristematic tissue growth [27,28]. Also, the significant superiority of the treatment of foliar spray with nano iron chelate fertilizer at a concentration of 45 mg. L^{-1}, as an increase in seedling diameter, may be due to the role of iron in plant vital activities as a catalyst in the formation of chlorophyll and increasing the amount of nutrients processed in the leaves, which leads to an increase in the efficiency of photosynthesis and this is positively reflected in plant growth [8]. The results of the study agree with the results of many studies that have shown the importance of using liquid organic fertilizers in improving the characteristics of vegetative growth and the content of leaves of chlorophyll, carbohydrates and proteins, as in the results of [29,30,31,32].

CONCLUSION

The study important role of foliar spraying with liquid organic fertilizer levels (Compo) in improving the studied characteristics, especially the concentration of 6 ml. L^{-1}, followed by a foliar spray treatment with nano-iron chelate fertilizer, so to obtain strong, good-growing olive seedlings.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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