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ROLE OF POTASSIUM AND SEAWEED EXTRACTS ON GROWTH AND LEAF MINERAL CONTENT OF "ASHRASI" OLIVE TRANSPLANTS

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Abstract

This study was conducted in a lath house, Dept. of Hort. and Landscape, College of Agricultural Engineering Sciences, Univ. Baghdad, Al-Jadriya during 2018 growing seasons to investigate the influence of potassium and seaweed extract spray on growth characteristics, leaf phenolic compounds and leaf mineral content of one year's old trees of "Ashrasi" olive cultivar. This study included two treatments: three levels of spraying of potassium sulfate (44 % K) at 0 (K_0), 2 $g.L^{-1}$(K_2) and 4 $g.L^{-1}$(K_4) and three levels of spraying of seaweed extract (Kelpak), 0 (S_0), 4 $ml.L^{-1}$(S_4), 6 $ml.L^{-1}$(S_6) and their interaction. Treatments were replicated three times at factorial experiment in a RCBD. The number of transplants used was 27 transplant .The results showed that, potassium sulfate spray at 4 $g.L^{-1}$significantly increased leaf area of 5.46 cm^2 , leaves chlorophyll content of 62.84 SPAD units , leaves potassium content of 1.93 % and highest leaf zinc content of 11.23 $mg.kg^{-1}$, also the results showed that the sprayed seaweed extract at levels 6 $ml.L^{-1}$superiority of the control treatment and gave the highest leaf area of 5.70 cm^2, leaves chlorophyll content of 62.41 SPAD units, leaves dry weight of 28.68 % and leaves carbohydrates content of 0.50 %. The interactions between potassium and seaweed extract spray significantly affected in all studied traits.

Keywords : Potassium, Seaweed extracts, Ashrasi, Olive transplants.

Introduction

Many of the olive orchard in Iraq suffer from weak growth and low yield, where the average productivity of the tree is still below the required level, and most of the areas of olive cultivation are in calcareous soil and high pH. Moreover, the olive trees are evergreen and so they consume large amounts of nutrients per year as the best growth and yield requires the availability of micro and macro nutrients with perfect available (Al-Rawi, 2013). In 2018, Estimated number of olive fruitful trees growing in Iraq, including nearly 485585 tree produces up to 12292 tons, and the average production per tree about 25.31 kg (PCBS, 2018). While the acreage of olive in the world reached about 10804517 hectare, with production of 20872788 tons (FAO, 2017).The main producing countries are Spain then Greece, Italy, Turkey and Morocco (FAO, 2017). In general, Iraq's production is less compared to world production, Therefore, it is necessary to care for trees, including fertilization, especially in the early stages of tree growth to obtain a high yield at the fruiting. Potassium is an important and essential element of plants, stimulating and activating plant enzymes and contributing to the achievement of many vital plant events (Allen and David, 2006). It is considered active for the work of many enzymes associated with photosynthesis processes and the representation of both proteins and carbohydrates in the plant, and helps in the transfer of carbohydrates from the areas of synthesis to other parts of the plant, maintain the building of proteins, membrane permeability and control of the pH of the cell, and helps to benefit from water by regulating stomata opening (Havlin *et al*., 2005). Several studies have been conducted to determine the role of potassium in growth, leaf mineral and chlorophyll content. Mayi and Saeed (2015) Mentioned that the foliar spray with 0,100 and 200 mg $KNO_3.L^{-1}$ caused significant increase in leaves potassium, iron and zinc content, especially at 200 $mg.L^{-1}$ in his study on olive transplants cvs. Khithary and I18. Al-Atrushy and Abdul-Qader (2016) reported that there was a positive correlation between the vegetative growth, leaf chlorophyll content and potassium sulfate of olive cv. Khadrawi. The use of marine algae or seaweed extracts has received a lot of attention recently because of the increasing interest in the environment and the emphasis on clean agriculture. These extracts are non-toxic to the user by their biological nature and are environmentally friendly and leave no residue on the plant and soil. In agricultural production, they are a partial substitute for or complementary to chemical fertilizers as they improve and increase the efficiency of fertilizers and thus contribute to lower production costs (Khan *et al*., 2009; Zamani *et al*., 2013). Several studies have been conducted on the role of these extracts in the growth of fruit trees, Ibrahim (2013) mentioned that the treatment of HojBlanca olive transplant with Sea Force (natural organic matter extracted from seaweed) showed higher stem diameter, leaves dry weight, shoot number, shoot length and leaf chlorophyll content . Al-Hadethi and Al-Qatan (2013) reported that algae extract increased the vegetative growth and leaf chlorophyll content of Labeeb-1-apricot cultivar. Al-Rawi *et al.* (2016) recorded that, highest content of leaves dry weight, chlorophyll, carbohydrates and zinc it was in "Peento" peach cultivar treated with seaweed extract at 4 $ml.L^{-1}$ as foliar spray. Due to few of similar studies in Iraq, this study aims to determine the effect of potassium and seaweed extract on vegetative growth of olive transplants.

Materials and Methods

This study was conducted in a lath house, Dept. Of Hort. and Landscape, College of Agricultural Engineering Sciences, Univ. Baghdad, Al-Jadriya during 2018 growing seasons to investigate the influence of potassium and seaweed extract spray on growth characteristics, leaf phenolic compounds and leaf mineral content of one year's old trees of "Ashrasi" olive cultivar. This study included two treatments: three levels of spraying of potassium sulfate (44 % K) at 0 (K_0), 2 $g.L^{-1}$(K_2) and 4 $g.L^{-1}$(K_4) and three levels of spraying of seaweed extract (Kelpak), 0 (S_0), 4 $ml.L^{-1}$(S_4), 6 $ml.L^{-1}$(S_6) and their interaction. Treatments were replicated three times at factorial experiment in a RCBD. The number of transplants used was 27 transplant. The following parameters were determined in the two successive seasons:

1. Leaf area: according to (Ahmed and Morsy, 1999) using the following equilibration: Leaf area = 0.53 (length x width) + 1.66.
2. Leaf chlorophyll contents (SPAD unit).
3. Leaf dry weight (%): by dividing weight after drying on weight before drying× 100.
4. Leaf carbohydrates content (%):was determined according to Dubois *et al* (1956).
5. Leaves potassium and zinc content: Potassium was determined using atomic absorption spectrophotometer "Perkin Elmer 1100B" after samples digested according to Estefan *et al*. (2013). Zinc were determined as $mg.kg^{-1}$ using atomic absorption according to Black (1965).
6. Oleuropein and Caffeic acid : were assayed according to (Montedoro *et al.,* 1996).

The obtained results were subjected to analysis of variance according to (Elsahookie and Wuhaib, 1990) using L.S.D 0.05 for comparing differences between various treatment means.

Results and Discussion

Effects of potassium and seaweed extracts spray on leaf area, Leaf chlorophyll content, Leaf dry weight and Leaf carbohydrates content :

Data concerning the effect of treatments on leaf area, leaves chlorophyll content, leaves dry weight and leaf carbohydrates content are listed in Table (1). The data cleared that, potassium sulfate spray at 4 $g.L^{-1}$ significantly increased leaf area of 5.46 cm^2, leaves chlorophyll content of 62.84 SPAD units and leaves dry weight of 28.53 %, While the potassium treatment did not affect in leaves carbohydrates content , the lower values of these traits was in control treatment. Table (1) also shows that the sprayed seaweed extract at levels 6 $ml.L^{-1}$ superiority of the control treatment and gave the highest leaf area of 5.70 cm^2, leaves chlorophyll content of 62.41 SPAD units, leaves dry weight of 28.68 % and leaves carbohydrates content of 0.50 %. The interactions between potassium and seaweed extract spray significantly affected in all studied traits. The reason for the increase in some vegetative traits may be due to the inclusion of seaweed extract on the nutrients that lead to increase the metabolic activities of the plant, including the potassium component necessary to activate the enzymes of the manufacture of amino acids and protein and also helps to manufacture important chlorophyll in the process of photosynthesis and the formation of sugars, proteins and energy compounds (ATP), all of which increase plant growth and size, leading to an increase in vegetative growth (Martin, 2012). Generally, these results are in harmony with those reported by Al-Rubaie (2011) on olive transplants. These results are in line with Al-Hadethi *et al*. (2014) which worked on potassium spraying on apricot trees.

Effects of potassium and seaweed extracts spray on leaf potassium, zinc, Oleuropein and Caffeic acid content :

Data concerning the effect of treatments on leaf potassium, zinc, Oleuropein and Caffeic acid content are listed in Table (2). The data cleared that potassium spray at 4 $g.L^{-1}$ significantly increased and gave the highest leaf potassium content of 1.93 %, highest leaf zinc content of 11.23 $mg.kg^{-1}$ and highest leaf oleuropein content of 8.63 $mg.g^{-1}$, while potassium spray did not affect on leaf caffeic acid content. Table (2) also shows that sprayed seaweed extract at levels 6 $ml.L^{-1}$significantly superiority of the control treatment and gave the highest leaf potassium content of 1.88 %, leaf zinc content of 11.24 $mg.g^{-1}$ and highest leaf oleuropein content of 8.65 $mg.g^{-1}$. The interaction between potassium and seaweed extract significantly affected all studied parameters excepting leaf caffeic acid content. The reason for these results may be due to increase growth as a result of foliar spray for potassium (table 1) and its role in increasing cell division and increasing root spread and deepening , and increase the ability of the roots to absorb important nutrients for plant growth (Adrian, 2004). These results are consistent with what was found by Saykhul *et al.* (2014) when spraying potassium on olive trees. These results are due to the effect of seaweed extract on increasing the percentage of zinc and potassium to contain the major nutrients, especially the N, P and K, as well as the microelements, which are absorbed directly when sprayed on the leaves and thus increase its percentage in the plant (Singh, 2003). These results are in agreement with those obtained by, Ibrahim (2013) on olive transplants.

Table 1 : Effects of potassium and seaweed extracts spray on leaf area, Leaf chlorophyll content, Leaf dry weight and Leaf carbohydrates content of "Ashrasi" Olive transplants

Leaf area(cm^2)					Leaf chlorophyll (SPAD unit)			
K_2SO_4	seaweed extract (Kelpak)				seaweed extract (Kelpak)			
	0	4	6	Mean	0	4	6	Mean
0	4.38	4.69	5.17	4.75	59.93	61.08	61.80	60.93
2	4.51	4.85	5.49	4.95	61.30	62.49	62.21	62.00
4	4.69	5.26	6.44	5.46	62.13	63.15	63.23	62.84
mean	4.53	4.93	5.70		61.12	62.24	62.41	
L.S.D 5%	K	Sea	Int.		K	Sea	Int.	
	0.21	0.21	0.36		0.45	0.45	0.80	
Leaf dry weight (%)					Leaf carbohydrates content (%)			
0	25.83	26.20	28.21	26.75	0.31	0.35	0.49	0.38
2	26.29	27.33	28.30	27.31	0.32	0.40	0.49	0.40
4	27.00	29.05	29.54	28.53	0.32	0.43	0.51	0.42
mean	26.37	27.53	28.68		0.32	0.39	0.50	
L.S.D 5%	K	Sea	Int.		K	Sea	Int.	
	0.61	0.61	1.06		N.S	0.05	0.09	

Table 2 : Effects of potassium and seaweed extracts spray on leaf potassium, zinc, Oleuropein and Caffeic acid content of "Ashrasi" Olive transplants

K (%)					zinc (mg.kg^{-1})			
K_2SO_4	seaweed extract (Kelpak)				seaweed extract (Kelpak)			
	0	4	6	Mean	0	4	6	Mean
0	1.58	1.66	1.69	1.64	10.13	10.37	10.57	10.36
2	1.67	1.75	1.88	1.77	10.52	10.70	11.25	10.82
4	1.81	1.92	2.07	1.93	10.79	11.00	11.89	11.23
mean	1.69	1.78	1.88		10.48	10.69	11.24	
L.S.D 5%	K	Sea	Int.		K	Sea	Int.	
	0.11	0.11	0.19		0.20	0.20	0.35	
Oleuropein (mg.g^{-1})					Caffeic acid (mg.g^{-1})			
0	8.11	8.20	8.33	8.21	11.31	11.36	11.37	11.35
2	8.40	8.49	8.70	8.53	11.32	11.34	11.40	11.35
4	8.43	8.55	8.92	8.63	11.40	11.44	11.33	11.39
mean	8.31	8.41	8.65		11.34	11.38	11.37	
L.S.D 5%	K	Sea	Int.		K	Sea	Int.	
	0.15	0.15	0.26		N.S	N.S	N.S	

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