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EFFECT OF HUMIC ACID AND SEAWEED EXTRACT SPRAY IN LEAF MINERAL CONTENT OF MANGO SEEDLINGS

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Abstract

This study was conducted in lath house, Dept. of Horticulture and Landscape Gardening, Coll. of Agricultural Engineering Sciences – Univ. of Baghdad during 2018 / 2019 growing seasons to investigate the influence of humic acid and seaweed extract spray on one year's old trees of "qalib al-thor" mango cultivar. This study included two treatments: three levels of spraying of humic acid (Disper Humic 85 %) at 0 (H_0), 1 ml.L^{-1}(H_1) and 2 ml.L^{-1}(H_2) and four levels of spraying of seaweed extract (Acadian), 0 (S_0), 2 ml.L^{-1}(S_2), 3 ml.L^{-1}(S_3) and 4 ml.L^{-1}(S_4) and their interaction. Treatments were replicated three times (two seedling in experimental unit) at factorial experiment in a RCBD. The number of seedlings used was 72 seedling. The results showed that, humic acid spray at 2 ml.L^{-1} gave the highest leaf nitrogen content of 1.403 and 1.743 %, the highest leaf potassium content of 0.520 and 0.463 %, highest leaf iron content of 190.6 and 235.3 ppm and highest leaf zinc content of 44.46 and 51.38 ppm for both seasons, respectively. Results also showed that seaweed extract at levels 4ml.L^{-1} gave the highest leaf nitrogen content of 1.423 and 1.720 %, highest leaf potassium content of 0.505 and 0.448 %, highest leaf iron content of 184 and 231.2 ppm and the highest leaf zinc content of 42.53 and 55.98 ppm for both seasons, respectively.

Key words : Organic fertilizers, humic acid, seaweed extract, leaves mineral, fruit trees.

Introduction

Mangoes (*Mangifera indica* L.) belong to family Anacardaceae. native to South Eastern Asia and considered one of the most important fruits of the tropical and sub tropical countries. Mango 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 (Paull and Duarte, 2011). The mango tree was planted in Iraq specifically in Basra province, where it was planted in Abu al-Khasib and Salihia, where there are large numbers planted among palm trees, as is noted in the home gardens in Basra province (Chakravarty, 1976). The acreage of mango in the world reached about 5681310 hectare, with production of 50649147 tons. The main producing countries are India then China, Indonesia, Pakistan and Brazil (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. Humic acids are a group of humic substances extracted from the soil by alkaline solutions or other nutrients and are in the form of dark brown structure solutions that do not have a fixed structural structure. They are a group of compounds with high molecular weights in their structure and characteristics. The natural characteristics of the humic acid vary in size and heterogeneity (Akanni and Ojeniyi, 2008). It also contains significant amounts of nutrients for the plant, Several studies have been conducted to determine the role of humic acid in leaves mineral content of fruit tree, El Kheshin (2016) was carried out during two successive seasons 2013-2014 on young mango transplants of Keitt mango cultivar, to evaluate the effect of humic acid treatments and found the application of humic acid at 150 ml.transplant^{-1} was recorded the highest nitrogen, phosphorus, potassium, calcium and magnesium content in the leaves, As has been Ibrahim and Al-Sereh (2019) found that foliar spray of guava seedlings with Potassium humate concentration at 4 ml.L^{-1} recorded a significant increase in leaves nitrogen, phosphorus and potassium content compared to control treatment.

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Table 1: Effects of Humic acid and Seaweed extract spray on Leaf N, P and K content of "qalib al-thor" mango seedlings during 2018 and 2019 seasons.

Season Seaweed (S)	2018				2019			
	Humic acid (H)				Humic acid (H)			
	0	1	2	Mean	0	1	2	Mean
N (%)								
0	1.333	1.342	1.366	1.347	1.515	1.552	1.612	1.560
2	1.345	1.379	1.389	1.371	1.565	1.573	1.723	1.620
3	1.391	1.396	1.406	1.398	1.537	1.689	1.813	1.680
4	1.403	1.416	1.449	1.423	1.622	1.713	1.824	1.720
Mean	1.368	1.383	1.403		1.560	1.624	1.743	
L.S.D5%	S	H	Inter		S	H	Inter	
	0.016	0.014	0.028		0.054	0.047	0.093	
P (%)								
0	0.339	0.342	0.349	0.343	0.363	0.298	0.334	0.332
2	0.343	0.349	0.353	0.348	0.289	0.372	0.329	0.330
3	0.358	0.359	0.368	0.362	0.331	0.328	0.333	0.331
4	0.362	0.386	0.393	0.380	0.335	0.333	0.326	0.331
Mean	0.351	0.359	0.366		0.330	0.333	0.331	
L.S.D5%	S	H	Inter		S	H	Inter	
	0.007	0.006	0.012		N.S	N.S	0.008	
K (%)								
0	0.433	0.477	0.505	0.472	0.403	0.433	0.452	0.429
2	0.452	0.489	0.517	0.486	0.422	0.441	0.461	0.441
3	0.457	0.511	0.522	0.497	0.429	0.446	0.466	0.447
4	0.466	0.513	0.536	0.505	0.431	0.442	0.472	0.448
Mean	0.452	0.498	0.520		0.421	0.441	0.463	
L.S.D5%	S	H	Inter		S	H	Inter	
	0.023	0.020	0.040		0.010	0.008	0.016	

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. 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 and Zamani *et al.*, 2013). Several studies have been conducted on the role of these extracts in leaf mineral content of fruit trees, Abed El Hamied (2014) found that application of two levels of seaweed extract spray lead to increased of leaves N,P,K, Mg, Fe, Zn and Mn content in "Sukkary" mango trees, Ibrahim *et al.*, (2015) found the growth, total chlorophylls, N, P and K in the leaves of Keitte mango trees in response to foliar application of seaweed extract at 10%**,** Al-Rawi *et al.*, (2016) recorded that, highest content of leaves nitrogen, potassium, iron, manganese 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 humic acid and seaweed extract spray on leaves mineral content of mango 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 and 2019 growing seasons to investigate the influence of humic acid and seaweed extract spray on leaf mineral content of one year's old trees of "qalib al-thor" mango cultivar. This study included two treatments: three levels of spraying of humic acid (Disper Humic 85 %) at 0 (H_0), 1 $ml.L^{-1}$(H_1) and 2 $ml.L^{-1}$(H_2) and four levels of spraying of seaweed extract (Acadian), 0 (S_0), 2 $ml.L^{-1}$(S_2), 3 $ml.L^{-1}$(S_3) and 4 $ml.L^{-1}$(S_4) and their interaction. Treatments were replicated three times (two seedling in experimental unit) at factorial experiment in a RCBD. The number of seedlings used was 72 seedling. Leaves samples were collected for chemical analysis at the 3rd week of June. Each sample consisted of 10 $leaves.seedling^{-1}$. Leaves were washed with water, rinsed with distilled water, and then dried at 70 cp until a constant weight, ground and digested according (Chapman, and Pratt, 1978). The following leaf mineral content were determined in the two successive seasons:

1. Nitrogen was estimated by micro-kjeldahl method of (A.O.A.C, 1980).
2. Phosphorus was estimate the chromatic by using spectrophotometer by (Estefan *et al.*, 2013).
3. Potassium was determined using atomic absorption spectrophotometer "Perkin Elmer 1100B" after samples digested according to Estefan *et al.* (2013).
4. Magnesium estimated by the Flame photometer according to the method proposed by (Haynes, 1980).
5. Iron and Zinc were determined as ppm using atomic absorption according to Carter (1993).

Table 2: Effects of Humic acid and Seaweed extract spray on Leaf Mg, Fe and Zn content of "qalib al-thor" mango seedlings during 2018 and 2019 seasons.

Season Seaweed (S)	2018				2019			
	Humic acid (H)				Humic acid (H)			
	0	1	2	Mean	0	1	2	Mean
Mg (%)								
0	0.232	0.236	0.275	0.248	0.217	0.226	0.233	0.225
2	0.238	0.245	0.269	0.251	0.224	0.237	0.241	0.234
3	0.244	0.248	0.279	0.257	0.231	0.240	0.248	0.240
4	0.246	0.255	0.285	0.262	0.237	0.254	0.262	0.251
Mean	0.240	0.246	0.277		0.227	0.239	0.246	
L.S.D5%	S	H	Inter		S	H	Inter	
	0.009	0.007	0.014		0.013	0.011	0.022	
Fe (ppm)								
0	123.6	144.5	178.5	148.9	157.8	182.8	205.6	182.1
2	130.2	160.4	184.8	158.5	166.9	197.5	225.8	196.7
3	133.6	171.3	192.8	165.9	180.7	204.8	244.6	210.0
4	156.8	188.9	206.4	184.0	200.6	227.7	265.2	231.2
Mean	136.1	166.3	190.6		176.5	203.3	235.3	
L.S.D5%	S	H	Inter		S	H	Inter	
	25.82	22.36	44.72		21.85	18.92	37.85	
Zn (ppm)								
0	31.25	33.87	40.56	35.23	33.89	36.90	42.64	37.81
2	33.27	37.64	44.76	38.56	38.42	44.86	50.89	44.72
3	34.26	40.41	43.70	39.46	41.78	47.84	53.34	47.65
4	36.61	42.14	48.80	42.53	56.68	52.60	58.66	55.98
Mean	33.85	38.52	44.46		42.69	45.55	51.38	
L.S.D5%	S	H	Inter		S	H	Inter	
	4.12	3.57	7.14		5.96	5.16	10.32	

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 Humic acid and Seaweed extract spray on leaf N, P, K content

Data concerning the effect of treatments on nitrogen, phosphor and potassium during 2018 and 2019 seasons are listed in (Table 1). The data cleared that, humic acid spray at 2 ml.L^{-1} gave the highest leaf nitrogen content of 1.403 and 1.743 %, the highest leaf potassium content of 0.520 and 0.463 % for both seasons, respectively, the treatments effect on leaves phosphorus content was significant for the first season only. (Table 1) also shows that sprayed Acadian (seaweed extract) at levels 4ml.L^{-1} gave the highest leaf nitrogen content of 1.423 and 1.720 % and the highest leaf potassium content of 0.505 and 0.448 % for both seasons, respectively. Also the seaweed treatments effect on leaves phosphorus content was significant for the first season only and gave 0.380 %. The interaction between humic acid and seaweed extract significantly affected all studied leaves content.

Effects of Humic acid and Seaweed extract spray on leaf Mg, Fe, Zn content

Data concerning the effect of treatments on leaves magnesium, iron and zinc content during two seasons are listed in (Table 2). The data cleared that, humic acid spray at 2 ml.L^{-1} gave the highest leaf magnesium content of 0.277 and 0.246 %, highest leaf iron content of 190.6 and 235.3 ppm and highest leaf zinc content of 44.46 and 51.38 ppm for both seasons, respectively. (Table 2) also shows that sprayed Acadian (seaweed extract) at levels 4ml.L^{-1} gave the highest leaf magnesium content of 0.262 and 0.251 %, highest leaf iron content of 184 and 231.2 ppm and the highest leaf zinc content of 42.53 and 55.98 ppm for both seasons, respectively. Seen from the results shown in the table 2 the interaction between humic acid and seaweed extract are affected significantly.

The role of humic acid in physiological processes comes through the promotion of enzymes and the transfer of photosynthesis products as well as a role of division and elongation of cells (Fawzy *et al.*, 2007), leading to increased growth, thus increased leaves mineral content. As well as the role of humic acid in improving the properties of soil, and containing this acid on a number of nutrients (Harper *et al.*, 2000) and therefore increased concentration of these elements in the leaves. These results are in harmony with those reported by Kheshin (2016) on mango trees, (El-Salhy, 2017) on Balady Mandarin. These results are due to the effect of seaweed extract on increasing the percentage of these elements 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 (Martin, 2012). These results are in agreement with those obtained by, (Al-Hadethi, 2015) on apricot trees, (Al-Hadethi and AL- Dulaimi, 2019) on olive transplants; they found that the leaves mineral content positively correlated with seaweed extract spray in those trees.

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