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Effect of Magnetized and Zamzam Water on the Growth and Yield of Lettuce (*Lactuca sativa* L.)

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Abstract:- A pot experiment was conduced at Faculty of Education, Alzaeim Alazhari University, to evaluate effect of magnetized water and Zamzam water on the growth and yield of lettuce. The results showed significant difference in shoot length, that area, shoot and root fresh and dry weight, chlorophyll content (a, b and carotenoids) and some chemical elements (Ca, Mg, K, P, Mn, Zn) compared with the control plants which was irrigated with tap water.

Keywords:- *Magnetic Water, Zamzam Water, Chlorophyll Content, Chemical Elements.*

I. INTRODUCTION

Efficient crop yield is generally associated with deficient send germination, and the vigorous seed ensures vigorous seedling that leads to high yield of crops. The improvement in seed germination have been achieved by different pre-sowing treatments including various physical factors such as the electric field, magnetic field, laser radiation and microwave radiation (Pietruszewski and Kania, 2010). These physical factors are regarded as being friendlier to the environment, and these factors often only modify the course of some physiological processes in the seeds, which increases their vigour and contributes to the improved development of plant (Galova, 1996; Podles *et al*, 2001). It is well known that Zamam water existed from old time at Makka in KSA since prophet Abraham, and used for drinking and plenty of this water goes to sewage system Zamzam water contains many important nutritive elements such a Ca, Mg, K, Fe, Cu, P, S, amonia, nitrates, Zn and Mn. Some works were carried out to investigate the effete of different mixtures of Zamzam water as irrigation water on some growth parameters of wheat and broad bean plant (Mutwally *et al*., 2000). The aim of this study was to determine the effect of magnetic and Zamzam Water in combination with either magnetized water of tap water on some plant growth parameters and yield of lettuce.

II. MATERIALS AND METHODS

The soil used in all treatments was a mixture of clay and sand soil (2:1). Zamzam water was brought from Makka, Saudi Arabia in big bottles. The magnetic device used for seed and water treatment, was a funnel shape, obtained from the local agent of Magnetic Technology Co. in Khartoum, lettuce seedlings one week old, all have almost 5cm shoot length and had the same number of leaves (two leaves) were transplanted in plastic pots (35cm in diameter and 35cm in depth). The water was added according to the prescribed treatments. During the experiment shoot length, number of leaves and leaf area were recorded and at the end of the experiment the shoot and root fresh and dry weight and root length were taken, chlorophyll content and some chemical elements were also recorded. The seedlings of lettuce were exposed to six treatments in a completely randomized design with three replication follow:

- Treatment one (T_1), normal seeds irrigated with tap water as a control.
- Treatment two (T_2), normal seeds irrigated with magnetized water.
- Treatment three (T_3), magnetized seeds irrigated with tap water.
- Treatment four (T_4), normal seeds irrigated with Zamzam water and tap water (1:5).
- Treatment five (T_5), magnetized seeds irrigated with Zamzam water and tap water (1:5).
- Treatment six (T_6) normal seeds irrigated with magnetized waer and Zamzam water (5:1).

III. RESULTS AND DISCUSSION

The data in Table (1) expressed a significance difference between treatments in shoot length of lettuce, number of leaves and leaf area. The higher shoot length values compared to control may be due to magnetized and Zamzam water, which contained a considerable amount of elements than that found in tap water. Table (2) showed a significant difference between the shoot fresh and dry weight of lettuce. The root fresh and dry weight showed also a significant difference between treatments. Similar results were obtained by Mutwally *et al*. (2008), who found high shoot fresh and dry weight of wheat irrigated with Zamzam water and with mixture of Zambzam and tap water. Also Alsokari (2011) found an increase in shoot fresh and dry weight of lentil, when treated with Zamzam water. In connection to this, Hamed *et al*. (2009) found high yield in *Vicia faba* and *Trificum vulgare* treated with Zamzam water. These results agreed with the results of Atak *et al*. (2003), Aladjadjiyan (2003), Shabranngi *et al*. (2010), Hozayn and Abdul Qados (2010). It is noticed that there is an increase in chlorophyll (a and b) and carotenoids content when the lettuce ether irrigated with magnetized or Zamzam water (Table 3). Similar results were obtained by Tian *et al*. (1991), Pietruszewski (1999), Rochlslea (2005), Celik *et al*. (2008) and Moussa (2011). Zamzam water also recorded maximum enhancement of photo-synthetic pigments and consequently increased photosynthetic rate which may be activated by ammonia (Winder and Egyum,

1996), by Cu (Delhaize *et al*., 1986), other studies referred such effect to the enhancement in the photo-synthetic pigments either by Fe Spiller *et al*. (1982, P (Hadad *et al*., 2009), or by Mn (Tiaz and Zeiger, 2006).

Treatment	Parameters measured		
	Shoot length (cm)	Number of leaves	Leaf area (cm^2)
T_1	16.90	10.00	48.80
T_2	19.96	8.00	68.50
T_3	18.93	18.00	52.46
T_4	18.90	18.00	50.39
T_5	18.50	16.00	51`.48
T_6	18.60	16.00	75.24

Table 1:- Effect of magnetic and Zamzam water on the growth parameters of lettuce.

Treatment	Parameters measured			
	Shoot fresh weight (g)	Shoot dry weight (g)	Root fresh weight (g)	Root dry weight (g)
T_1	4.21	1.63	1.39	0.07
T_2	4.56	1.84	1.69	0.08
T_3	3.01	1.90	1.47	0.74
T_4	5.12	2.37	2.20	0.15
T_5	6.07	3.30	2.93	019
T_6	6.37	2.42	3.47	0.14

Table 2:- Effect of magnetic and Zamzam water on the yield parameters of lettuce.

It is clear from Table (4) that magnetized and Zamzam water treated plants achieved high nutrient content in forms of Ca, Mg, K, P, Mn, Zn and Fe. The Ca concentration increased in the different treatments compared with the control. Plant processes such as growth, photosynthesis, mineral nutrition, water transport are quite related to the motion of Ca^{++} and other ionic current density across cellular membrane. These are important changes which are due to magnetic field (Florez *et al*., 2007). The magnesium expressed the highest value (733.2ppm) in treatment (T_2) while the lowest value (332.4ppm) was found in treatment (T_1), the control. Magnesium ions are found in the centre of chlorophyll molecules, and as chlorophyll is essential component in the reaction of photosynthesis, which produces energy for growth, magnesium ions are therefore essential (Bohn *et al*., 2004). As concerning potassium the highest value (3.960ppm) was observed in treatment (T_6), while the lowest value (3.644ppm) was found at the control. Similar results were reported by Moussa (2011), who found a significant increase in potassium content in magnetized water treatment of common bean. Also the work of Grewal and Maheshwari (2011) who observed an increase in potassium content in pea after irrigation with magnetic water. In this connection Hamed *et al* (2009) working with different water types on broad bean and wheat, found an increase in plant irrigated with Zamzam water. In regard to phosphorous the highest value (9.231ppm) was observed at treatment T_5 and the lowest value (6.561ppm) at the control. These results agree with the results of Al Khazan *et al*. (2011) who found an increase in phosphorus content in jojoba treated with magnetic water. Also Zamzam water showed an increase in phosphorus content in broad bean and wheat (Hamed *et al*., 2009). Amino acids and protein content may be also increased because P increased the bio-conversion of nitrate into amino acids (Rufty *et al*., 1990). The increment caused by Zamzam water may be explained due to the positive effect of P role in the nucleoprotein biosynthesis and/or ATP biosynthesis (Tiaz and Zeiger, 2006). The highest concentration of Mn (11.923ppm) in lettuce was detected in treatment (T_6) and the lowest value (28.00ppm) was found at the control. Similar results were reported by Hamed *et al*. (2009). Mananese may increase amino acids biosynthesis through increasing superoxide dismutases enzyme (Sevilla *et al*., 1982). Irrigation with magnetized and Zamzam water exhibited a marked increase in zinc content in the different treatment. The highest value (18.737ppm) was observed at treatment (T_3), while the lowest value (7.612ppm) was recorded at treatment (T_1 the control. Similar results were obtained by Abdul Latif and Baeshr (2013) working with lens esculents and *Phaseolus vulgaris* found higher accumulation of N, Cu, Zn in plant watered with tap and Zamzam water. Also Hamed *et al*. (2009) found an increase in Zn content in broad bean and wheat when watered with Zamzam water.

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Treatment	Chlorophyll		Carotene
	(a)	(b)	
T_1	1.082	0.497	2.403
T_2	2.557	1.192	3.557
T_3	2.291	1.172	3.636
T_4	2.539	1.132	3.51
2.538	1.211	3.414	019
2.077	1.054	3.489	0.14

Table 3:- Effect of magnetic and Zamzam water on chlorophyll content of lettuce.

Treatment	Chemical elements					
	Ca	Mg	K	P	Mn	Zn
T_1	370.5	332.40	3.644	6.561	28.00	7.612
T_2	505.6	733.20	3.808	7.537	30.00	10.536
T_3	380.4	458.25	3.708	6.778	29.25	18.737
T_4	386.5	369.26	3.640	8.338	28.61	14.937
T_5	489.5	451.00	3.720	9.231	40.39	9.193
T_6	643.5	636.38	3.960	8.645	119.23	15.330

Table 4:- Effect of magnetic and Zamzam water on chemical constituents of lettuce.

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