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IMPACT OF MAGNETIZED SEAWATER APPLICATION AND BIOFERTILIZATION ON SEEDLINGS GROWTH AND CHEMICAL CONSTITUENTS OF *SWIETENIA MACROPHYLLA* KING SEEDLINGS

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Abstract

This trail was conducted at El-Qanater El-Khairia Horticultural Research Station, Qalupia, Egypt, during two successive seasons of 2016-2017 and 2017-2018 to investigate the effect of magnetized seawater and biofertilization on seedlings growth and chemical constituent of *Swietenia macrophylla*. Four diluted seawater at concentrations of (2000, 4000, 5000 and 6000 ppm) as well as control (non-saline water) have taken and four treatments were used namely magnetized seawater alone, biofertilizer with alga mixture (*Anabaena* sp. and *Nostoc* sp.) as nitrogen-fixing ability, biofertilizer plus magnetized technique and the control that non-magnetized and non-biofertilized. The obtained results demonstrated that different salinity levels significantly reduced increment of height growth rate, stem diameter, leaf area, root length, fresh and dry weight biomass. Furthermore the high levels of 5000 and 6000 ppm caused the death of all plants and survived only when the plants exposed to magnetized field treatment or biofertilization. Adding the magnetized device alone, biofertilizer and magnetized water plus biofertilizer overall. Exceeded the increment of height growth rate by 22.61, 36.68 and 74.66% over control respectively. Moreover irrigating water at the level of 2000 ppm salinity combined with magnetized seawater plus bio fertilizer increased the percentage rate of height growth by 23.36% over control (non saline). At any level of salinity the treatment of magnetization with or without biofertilizer enhanced the leaves area and root length comparable with control. Total chlorophyll in leaves and total carbohydrate in stem reduced related to increasing salinity levels. Also, the salinity decreased the elements of N, P and K% in leaves content and increased Na content. Treatments of magnetization and biofertilization significantly accelerated formation total chlorophyll and carbohydrates than control and the levels of salinity 2000 and 4000 ppm combined with magnetization with or without biofertilizer revealed increases in total chlorophyll more than control. Magnetic treatment and bio fertilizer ameliorated and raised N, P and K% content in leaves beside reduced the absorption Na% led to the increases in ratio K^+: Na^+. The magnetic treatment plus biofertilizer was more beneficial than separate addition, in which the magnetic technique alone was less effective at the highest level of salinity and adding saline water at a level of 5000 or 6000 ppm alone affective negatively most of the growth parameters and reduced both of N, K and P% but increased Na% and the ratio of K^+: Na^+. It can be concluded that using both of biofertilizer and magnetized treated saline water irrigation was more beneficial in restricting the injurious referred to salinity stress.

Key words: Seawater, Magnetic Water, Cyanobacteria, timber trees

Introduction

Water shortage and low water quality are becoming an international issue, especially in the arid and semi-arid region due to several reasons; water resources are being always under pressure and require a scientific approach to sustain the productivity of crops. Besides the use of low- quality irrigation water is achievement important in the agricultural sector in many countries all over the world because of the water quality problems and due to the scarcity of good quality water.

Salinity is a major a biotic stress factor reducing the yield of a wide variety of crops (Tester and Davenport, 2003). Salinity stress depresses plant growth and development at different physiological levels. The reduction in plant growth by salinity stress might be related to adverse effects of excess salt on ion homeostasis, water balance, mineral nutrition and photosynthetic carbon metabolism (Munns, 2002). Plants growing in saline media come across generally with major drawbacks; the first is the increase in the osmotic stress due to high salt concentration of soil solution that decreases water potential of soil; the second is the increase in the concentration of Na and Cl exhibiting tissue accumulation of Na and Cl and inhibition of mineral nutrients uptake (Mesut *et al.,* 2010). Alssefat (2006) on *Khaya senegalensis* showed that plant height, stem diameter, leaf area, root length, fresh and dry weight of above-ground parts were decreased with increasing salt concentration compared with control.

Garcia *et al.,* (2007) on maize plants showed that the increase of soil salinity by irrigation with saline water resulted in increased the sodium content and also the relationships of Na^+/K^+ besides, Magnetic water treatment (MWT) is currently being used offers many other benefits in agriculture such as increased yield, early maturity and increased fertilizer uptake Hizayn and Qados (2010). Taha *et al.,* (2011) also, reported that magnetic increased plant growth and leaf mineral content on cauliflower, Maheshwari and Grewal (2009) on tomato clear that MTW has played important role in improving the availability of these elements to plants and noticed that using magnetized water reduced-sodium percentage in tomato leaf. And found that the magnetic treatment significantly increased the dry matter content of the plant and the N, P, K content, Zlotopolski (2017) showed that MWT reduced-sodium concentrations in soil by leaching it below root zones. This could explain why plants treated by MWT had less leaf sodium levels compared to non-MWT. Vladimir Zlotopolski (2017) on lettuce indicated that total chlorophyll and concentrations of some macro and micro-nutrients in plants treated by MWT could be achieved. MWT may also help counteract the effect of harmful sodium build up in plants when less irrigation water was used.

Cyanobacteria have been applied with success for the reclamation of saline soils (Borowitzka 1986). Vaishampayan *et al.,* (2001) the majorities of cyanobacteria are capable of fixing atmospheric nitrogen and are effectively used as biofertilizers, (Zulpa *et al*., 2003) found that the cyanobacteria are a continually renewable biomass source that can release to the environment soluble organic substances. These substances can be vitamins, enzymes, carbohydrates, peptides, amino acids and growth promoters, Cyanobacteria, such as Nostoc and Anabaena can be a useful potential biofertilizer since it can both photosynthesize and fix N with great adaptability to various soil types (Mishra and Pabbi, 2004).

Swietenia macrophylla King, Fam. Meliaceae. It is tropical tree species native to Central and South America. It is distributed generally corresponds to forests classified as tropical dry with annual temperature average of greater than or equal to 24^0C and 1000 – 2000 mm an annual precipitation (Holdridge, 1967). The species has been extensively planted in southern Asia and Pacific it has also been introduced into West and North Africa especially Egypt. It is one of three species in the genus, can reach a height of up to 40m with a trunk up to 2 m in diameter (Pennington, 2002). It is one of the most important timber species in world trade. Principally used for making furniture and interior things and has been an important component in construction and shipbuilding (Lamb, 1966).

The present study aimed to evaluate the effects of Magnetic treatments and application algae as biofertilizer on vegetative growth and chemical composition of *Swietenia macrophylla* seedlings watered with different levels of diluted seawater.

Materials and Methods

The present study was carried out during the two successive seasons of 2016/2017 and 2017/2018 at the experiment area of Forestry and timber tree Departmental, at El-Qanater El Khairia Horticultural Research Station, Qalioubia Government, 20- km northwest of Cairo.

The experimental design

The pots were distributed in split plot design treatments where the main plot was the salinity levels of diluted seawater 2000, 4000, 5000 and 6000 ppm as well as control (Nile water) but the magnetized system and biofertilizer as subplot namely magnetic system alone biofertilizer single, magnetic plus biofertilizer beside control (non-magnetic and non-biofertilizer) and three replicates were used and each replicate included all the treatments of salinity, magnetized system and boifertilization in which each saline concentration was represented by 48 seedlings while each magnetized system treatment include 12 seedlings and biofertilization include 12 seedlings during the first and second season. The statistical analysis was conducted according to Snedecor and Cochran (1980). Significant differences among the means of various treatments were compared by new L.S.D. at 5% probability. The pots were subjected to thick polyethylene sheets in the open field to prevent the penetration of growing roots into soil surface under pots.

The physical and chemical analyses of the grown media were performed as described by Piper (1947) and Klute (1986) as shown in table 1.

Plant materials

Swietenia macrophylla King (big-leaf mahogany) were used in this study, one-year-old uniform seedlings

Table 1:

1: Chemical analysis of the soil.

Cations (Meq/L)				Anions (Meq/L)				Sp
K^+	Na^+	Mg^{++}	Ca^{++}	SO_4^-	Cl^-	HCO_3^-	CO_3^-	
0.30	10.78	6.96	11.96	15.75	13.15	1.10	-	20.00

2: Physical analysis of the soil.

Soil type	Clay %	Silt %	Fine Sand %	Coarse sand %	$CaCO_3$	OM	Ec ds/m	pH
Sandy loam	4.30	10.20	45.40	40.10	1.00	0.70	3.00	7.51

3: Chemical properties of Seawater mg/kg of seawater.

Cations				Anions				
K^+	Na^+	Mg^{++}	Ca^{++}	SO_4	HCO_3^-	Cl^-	EC (ppm)	ph
390	10752	1295	416	2701	145	19345	35.044	8.28

planted on March 1st, 2016 and 2017. In the average height of (25 cm) grown in the nursery of Forestry Department, Horticulture Research Institute and transplanted individually in black plastic pots (25cm diameter) fill with 6 kg sandy loam soil transported from reclaimed new soil, near Alexandria.

Nile water was used in irrigation of the planted pots for a month then on April 1st, 2016 and 2017 through both seasons the irrigation treatments were started in which three different concentrations of diluted seawater of 2000, 4000 and 6000 ppm. Saline water, as well as the control (non-salinized) in the first season and 5000 ppm concentration salinity in water irrigation was used in the second season instead of 6000 ppm level which caused the death of plants that irrigated with it in the first one. Each diluted seawater treatment and Nile water as control exposed to the magnetized or non-magnetized field before applying the irrigation. A magnetic tube (magnetron) was used to pass the water through it for the treated magnetic water device 250 mT magnetron unit of 3.5cm diameter which produced by magnetic technologies (Germany).

To implement the irrigation water treatments, a big water container with a tap (50 L) was used and the water flow rate was fixed in all treatments. For the magnetically water treatment, the magnetic field unit has been attached to the tap of the container and the water was passed through it, then the magnetized water was collected into a smaller container to use it in the irrigation. The same procedure was applied both in Nile water or saline water.

The saline water used in the study was prepared by adding measured amounts of seawater (35000 ppm) transported from the Mediterranean Sea, in Alexandria to Nile water to achieve the required salinity levels to obtain the concentrations (2000, 4000, 5000 and 6000 ppm) using an electrical conductivity meter.

The main irrigation scheduling strategy used in the study was to apply enough water to bring the soil back to field capacity at the end of each irrigation.

The plants were irrigated alternative days that twice-weekly interval in winter and every three times weekly in summer season up to field capacity and the volume of irrigation water applied was determined by knowing the changes pot weight due to evapotranspiration since the last irrigation.

Every three times of irrigation by saline water one time of freshwater was used to leach the soil and avoid accumulate of the salinity.

All pots received of NPK fertilizers, 5g calcium superphosphate (15.5% P_2O_5) which was added immediately after planting, 2g potassium sulfate (48% K_2O) and 4g ammonium nitrate (33.5% N). Recommended by (Abd El-Dayem, 1988).

Biofertilizer by the mixture of cyanobacteria (*Anabaena* oryza and *Nostoc* muscorum) as nitrogen-fixing ability were added by The filtrate of algal cultures at the rate of 1.2 ml/pot (Reddy *et al.*, 1986).

Each culture was grown for one month where added four applications to the soil throughout (0, 2, 4 and 6 weeks) after planting.

Cyanobacteria strains were obtained from the Microbiology Department, Soils, Water and Environment Res. Inst., Agric. Res., Center. The cyanobacteria strains were grown separately on BG11 medium (Rippka *et al.*, 1979).

The following parameters were recorded after 12 months from treatments in 2016 and 2017 seasons.

A. Determination of vegetative growth:

1. Increment seedling height growth rate (cm)
2. Stem diameter (cm)
3. Leaf Area (cm^2)

4. Root length (cm)

5. Fresh and dry weight biomass was estimated.

B. Chemical Analysis

The following chemical constituents were determined:

Total Chlorophylls determination (mg/gm f.w.) in leaves

The total Chlorophyll was extracted from fresh leaves taken from the middle part of the stem of experimental plants using the DMSO method based on Barnes *et al*. (1992) and determined colourmeterically.

Determination of total carbohydrates in stems

Total carbohydrates in stems were determined as the percentage described by Dubois *et al*. (1956).

Determination of some elements as percentage i.e.

The nitrogen content of dried samples of leaves was determined by the modified micro kjoldahl method as described by Pregl (1945).

Phosphorus percentage in leaves was measured with a spectrophotometer at 880 nm according to the method described by Rowell (1993). Sodium concentration as a percentage was determined using a flame photometer according to the method described by Irri (1976). Potassium was determined using the flame photometry method of Black (1982).

Results and Discussion

Increment of seedling height growth

Table 2 cleared that salinity inhibited the rate of height growth in both seasons. The high salinity levels of 5000 and 6000 ppm greatly depressed the rate of growth height as this reduction equilibrium 72.4% and 69.83% in the first and second season than the control, respectively, also it is cleared that there are highly significant differences among the used different concentrations of 2000, 4000, 5000 and 6000 ppm salinity in both seasons.

Magnetization and biofertilization treatments significantly increased rate of height growth compared with control moreover there were significant differences in between and the highest rate was 25.57 cm in treatment of magnetized plus bio fertilized followed by those of biofertilizer alone 20.01 cm and the intermediate was 17.95 cm in the plants exposed to magnetic field only while the lowest rate 14.64 in control in the first season respectively regardless the effect of salinity. It can result that the treatment of biofertilizer plus magnetic technique was more beneficial and gave the best height growth rate; it is a fact in both seasons.

The interaction among salinity and magnetized or biofertilization treatments cleared that the highest mean values of height growth rate were 33.67 and 27.78 exhibited with the seedlings irrigated by Nile water combined with the treatment of magnetization plus bio fertilization, in both seasons respectively. On the other hand, it can be noticed that the treatment of 6000 ppm saline water alone resulted in mortality the seedlings with the exception those exposed to a magnetic field plus biofertilizer in the first season however treatment of 5000 ppm salinity and exposed to either magnetization or biofertilizer alone survived although the rate of height growth had inferior value. Also, the seedlings irrigated with 2000 ppm saline water and treated with magnetization alone, magnetization plus biofertilization increased the height growth rate 2.87 and 23.36% over control that irrigated with non saline water respectively. Generally the magnetized system with or without bio fertilizer associated withstanding the plants to salinity.

Stem diameter (cm)

Data existed in table 2 indicated that stem diameter of *Swietenia macrophylla* seedling treated by magnetized seawater plus biofertilizer produced significantly the highest thickest stem diameter 0.987 cm followed by those treated with biofertilizer alone 0.971 cm while the intermediate was the treatment of magnetized water only 0.746 cm and the late was 0.686 cm. in control, the similar trend was obtained in the second season approximately. It means that the magnetized seawater technique was more positively affected stem diameter irrespective of the effect of salinity.

As for the effect of salinity, the results of table 2 cleared reduction in stem diameter related to the concentrations of salinity especially at high levels of 5000 and 6000 ppm.

It worthily noticeable that the treatments of the magnetized system and biofertilization enhanced stem diameter even so with saline water irrigation at the level of 2000 ppm better than those irrigated by Nile water without using magnetized technique application or biofertilizer but when the levels of salinity increased to 6000ppm the stem diameter reduced even though using the magnetized system. However, at any level of salinity, the treatment of magnetization and biofertilization improved stem diameter compared with control.

Leaf area (cm^2)

As shown in table 2 leaf area of *Swietenia macrophylla* significantly reduced due to irrigation the plants by different diluted of seawater at the levels of 2000, 4000 and 6000 ppm compared with control and among these levels consequently, the reductions in leaf

Table 2: Average of Increment of height growth, stem diameter and leaf area of *Swietenia macrophylla* as affected by magnetized seawater treatment and biofertilization during 2016/2017 and 2017/2018 seasons.

Salinity	Nile water	2000	4000	6000	Mean	Nile water	2000	4000	5000	Mean
Treatments	First season; 2016/2017					Second season; 2017/2018				
Increment of height growth(cm)										
Control	23.33d	19.78g	15.44j	0.01l	14.64D	23.56c	18.11f	13.33h	0.01i	13.75D
Magnetization	28.67b	24.00d	19.11gh	0.01l	17.95C	27.11a	21.89d	16.11g	9.89i	18.75C
Biofertilizer	27.11c	22.22e	18.22i	12.50k	20.01B	27.33a	21.22d	17.44f	12.89h	19.72B
Magnetization + biofertilizer	33.67a	28.78b	21.33f	18.50hi	25.57A	27.78a	26.00b	19.78e	9.11j	20.67A
Mean	28.20A	23.70B	18.53C	7.76D		26.45A	21.81B	16.67C	7.98D	
Stem diameter (cm)										
Control	0.970de	0.933ef	0.840gh	0.001i	0.686D	1.057e	0.977f	0.887gh	0.001i	0.730C
Magnetization	1.087b	1.007cd	0.890fg	0.001i	0.746C	1.200ab	1.123d	0.963f	0.850h	1.034B
Biofertilizer	1.150a	1.043bc	0.943ef	0.750hi	0.971AB	1.220a	1.147cd	1.057e	0.887gh	1.078A
Magnetization + Biofertilizer	1.163a	1.13bc	0.937ef	0.803h	0.987A	1.233a	1.170bc	1.057e	0.893g	1.088A
Mean	1.093A	1.02B	0.903C	0.388D		1.178A	1.104B	0.991C	0.658D	
Leaf area (cm)^2										
Control	184.4e	172.6e	116.2gh	0.01i	118.3D	236.7d	224.7d	162.6f	0.01g	156.0D
Magnetization	270.1a	176.6e	138.2f	0.01i	146.2C	293.0a	250.0c	193.6e	157.9f	223.6B
Biofertilizer	232.5c	182.3e	138.9f	108.1h	165.4B	265.4b	236.0d	193.7e	151.1f	211.5C
Magnetization + Biofertilizer	270.7a	255.1b	210.0d	127.5fg	215.8A	289.1a	256.1bc	228.9d	200.2e	243.6A
Mean	239.4A	196.7B	150.8C	58.9D		271.0A	241.7B	194.7C	127.3D	

* Mean values in the same column of different treatment followed by the same capital liters are non -significant at 5% probability.** Mean values in the same row of different salinity levels followed by the same capital liters are non-significant at 5% probability.*** Mean values in each column and row followed by small liters are non-significant at 5% probability.

area were 17.84, 37.01 and 75.44% in the first season and they were 10.81, 28.15 and 53.03% than control, respectively in the second one, regardless the effect of magnetized system and biofertilization.

The results cleared that the plants were treated by magnetized water plus biofertilizer induced significantly the biggest leaves area. Followed by Treatment of using biofertilizer single and intermediate was the treatment of magnetized water alone. It is observed that increments in leaves area equilibrium 82.16, 39.70 and 23.58% over control.

The plants were treated with magnetized fields with or without biofertilizer combined with the irrigation by Nile water produced the highest averages in leaves area. On the other hand, the plants irrigated by saline water at the level of 2000 ppm or 4000 ppm and treated with magnetized field plus biofertilizer pronounced increases in leaves area more than those irrigated by Nile water without utilizing magnetize techniques or biofertilizer where the increases attained 38.34% and 13.88% respectively in the first season. From the previously obtained results, it can be concluded that using magnetized water or biofertilizer treatment was more favorable and beneficial with saline water where lessed the injurious of salinity, It means that magnetized technique ameliorated the status of plants and involved in withstood the salinity. The previously obtained results coincided with those findings of Mostafa (2002) who reported that the height of *Calendula officinalis* and Moraji was significantly reduced with increasing salinity > 3.8 dsm^{-1}. These results may be due to the effect of salinity on reducing the influx concentration of the absorption of the nutrients by the plant (the ratio between the uptake of nutrients and water). The herein obtained results illustrated that magnetization enhanced the seedling height, stem diameter and leaf area of *Swietenia macrophylla* were harmony by Helal (1998) reported that using magnetized seawater or biofertilizer led to increasing the height of *Dimorohatica* plants and it may be due to the influence of magnetic treatment enhanced soil acidity (pH) value and water retention in the rooting medium hence the availability and absorption of nutrients could be enhancing led to more initiation and elongation of stem cells, besides the magnetic considering of water may be an influx of electron which may effect the microorganisms such as *Azotobacter* sp., also El-Nashawy (1997) cleared using magnetic or biofertilizer single resulted in the tallest plants similar results were cleared by Khattab *et al.,* (2000) on Gladulus hybrids they reported that under the different levels of salinity the addition of magnetic treatment or biofertilization led to producing a large area of Maiji leaves Abou El-Yazied *et al.,* (2011) on tomato showed that irrigation by magnetically treated water enhances the leaf area in the grown seedling.

Concerning the effect of biofertilizer on vegetative growth, the obtained results were harmony with the finding of many scientists such El-Gaml (2006) explained that biofertilization using cyanobacteria led to increased microbial diversity community in the soil through increased organic matter, microbial activity and nitrogenase activities and subsequently improved soil fertility and enhanced the growth parameters. Shanan and Higazy (2009) revealed that biofertilization with Azot., *Azo* sp. and Cyano increased significantly plant height and leaf area as compared to mineral fertilization.

As for the effect of salinity, many researchers were in agreement with the obtained results such as Meloni *et al.,* (2004) on *Prosopis alba,* Rowland *et al.,* (2004) on *Poplus deltoids and* Alssefat (2006) on *Khaya senegalensis* all of them showed that plant height, stem diameter, leaf area and plant biomass were decreased with increasing salt concentration compared with control.

Root length (cm)

As shown in table 3 the results in both seasons indicated that root length significantly reduced due to saline water comparable with those of control. The values depressed than control by 14.54, 35.22 and 70.88% in the first season for the plants irrigated with saline water at levels of 2000, 4000 and 6000 ppm, irrespective the effect of magnetization and biofertilization. The plants exposed to magnetized field plus biofertilizer root length attained to the longest one 28.31 cm, in addition as the plants treated by biofertilizer alone, root length also increased 27.06 cm in the second season.The previous results cleared that expose the plants to the magnetic field with or without biofertilization resulted in an increased root length compared to control. Concerning the interaction, it can be concluded that the longest root length of 31.33 cm and 34.22 cm appeared in seedlings biofertilized only or exposed to magnetized field plus biofertilization combined with the irrigation by Nile water in the first and second season, respectively. It is evident that root length increased 9.68% and 5.45% in the first and second season over control in plants irrigated with 2000 ppm salinity and treated with magnetization plus biofertilizer. This fact appeared in both seasons. It means that magnetic water either with or without biofertilizer improved the root length of salinized seedling than non-magnetically although the plants irrigated by freshwater.

The obtained results were similar to those reported by many investigators such as Meloni *et al.,* (2004) on *Prosopis alba.,* Rowland *et al.,* (2004) on *Populus deltoids*, Khan *et al.,* (2009) on *Acacia nilotica* and Soliman (2015) on *Moringa peregrine* and Alssefat (2006) on *Khaya senegalensis* all of them showed that the root length decreased with increasing salt concentration compared with control.

Table 3: Average of root length, biomass fresh and dry weights (gm) of *Swietenia macrophylla* as affected by magnetizing seawater treatment and biofertilization during 2016/2017 and 2017/2018 seasons.

Salinity Treatments	Root length (cm)									
	Nile water	**2000**	**4000**	**6000**	**Mean**	**Nile water**	**2000**	**4000**	**5000**	**Mean**
	First season; 2016/2017					**Second season; 2017/2018**				
Control	26.44c	21.11e	15.22f	0.01h	15.69D	28.45c	25.44f	22.44ij	0.01k	19.08D
Magnetization	29.89b	24.78d	15.89f	0.01h	17.64C	29.11c	27.00d	24.56g	22.34j	25.75C
Biofertilizer	31.33a	26.44c	21.22e	21.00e	25.00A	30.00b	28.33c	26.45de	23.45h	27.06B
Magnetization + Biofertilizer	30.89a	29.00b	24.45d	13.50g	24.46B	34.22a	30.00b	25.78ef	23.22hi	28.31A
Mean	29.64A	25.33B	19.20C	8.63D		30.45A	27.69B	24.81C	17.25D	
Biomass fresh weight (gm)										
Control	46.22d	35.84e	24.1g	0.01h	26.74D	42.97c	36.07e	30.81g	0.01i	27.46B
Magnetization	59.15b	45.19d	28.41fg	0.01h	33.19C	48.56b	43.28c	36.36e	32.68fg	40.22A
Biofertilizer	60.10b	49.14d	37.25e	30.83f	44.33B	50.55ab	43.42c	39.38d	27.68h	40.26A
Magnetization + Biofertilizer	70.02a	54.48c	40.17e	30.07f	48.69A	52.14a	44.72c	34.55ef	27.44h	39.71A
Mean	58.87A	46.16B	32.69C	15.23D		48.56A	41.87B	35.28C	21.95D	
Biomass dry weight (gm)										
Control	17.91cd	14.45e	10.05f	0.01g	10.60D	17.00d	12.93f	10.73g	0.01i	10.17C
Magnetization	23.49b	16.65d	9.91f	0.01g	12.51C	18.77c	15.97e	13.04f	10.93g	14.68AB
Biofertilizer	24.99b	18.44c	14.17e	12.73e	17.58B	19.79b	15.82e	12.81f	9.76h	14.54B
Magnetization + Biofertilizer	31.18a	23.61b	18.79c	13.01e	21.65A	20.90a	16.47de	12.74f	10.12gh	15.06A
Mean	24.39A	18.29B	13.23C	6.44D		19.12A	15.30B	12.33C	7.70D	

Sarhan *et al.*, (2018) showed that salinity concentration at levels of 2000 and 4000 ppm significantly decreased root length of *Swietenia macrophylla* while the highest level of 6000 ppm saline water caused the death of seedling in agreement with the herein present results. The obtained results of magnetically treated water were in harmony with the finding of De Souza (2005) who cleared that magnetic treatments led to a remarkable increase in plant root length. Anand *et al.*, (2015) showed that the use of a combination of all these Cyanobacterial isolates in consortium with Maize crop showed a significant increase in the root lengths.

Biomass fresh and dry weights (gm)

As shown in table 3 fresh weight biomass of seedlings significantly declined in both seasons than the control, due to salinity levels of 2000, 4000 and 6000 ppm and there are significant differences among the different levels of salinity in irrigation water since the reduction parentages attained 21.59, 44.47 and 74.3% less than control, respectively.

In this respect, the influence of magnetized system and biofertilization it can be concluded that fresh biomass weight was the significantly maximized heaviest 48.69gm as a result to the treatment of magnetized seawater plus biofertilizer followed by those treated by biofertilizer single 44.33gm, on the other hand, the plants exposed to the magnetized system alone recorded the intermediate 33.19gm while the last one 26.74gm in the plant of control that non-magnetize or non- biofertilization.

From the aforementioned it can be concluded that the exposure to the magnetic system with or without biofertilizer was beneficial and resulted more fresh biomass comparable to control plants, in addition, the plants irrigated by saline water at the level of 2000 ppm combined with magnetized water both biofertilizer with or without exceeded fresh biomass 17.87% and 6.32%, respectively meaning that both of them ameliorated the growth of plants irrigated with saline water at level of 2000 ppm but when the level of salinity increased more than 2000 ppm the promoted effect of magnetically or biofertilizer reduced compared to control.

Concerning dry biomass the results of table 3 have been taken the same trend approximately to those of fresh biomass otherwise the plants exposed to the magnetized system plus biofertilizer and irrigated by saline water at the level of 2000 or 4000 ppm increased dry biomass by 31.82% and 4.91% over the control in the first season.

The previously obtained results were in harmony with the findings of Ali *et al.*, (2011) on *Chrysophyllum oliviform*, *Tamarindus indica* and *Terminalia arjuna* found growth and biomass measurements of each tree species decreased as salinity increased.

As regards, the effect of biofertilization the obtained results from the herein study were in accordance with the obtained by Boghdady and Ali (2013) on wheat cultivars, Mohsen *et al.*, (2016) on Lettuce Plants (*Lactuca sativa* L.) and Grzesik *et al.*, (2017) found that biofertilization with cyanobacteria and green algae improved the growth of willow (*Salix viminalis* L.).

Total chlorophyll

The present data of table 4 apparently cleared that total chlorophyll significantly reduced in the leaves of *Swietenia macrophylla* in relation to different levels of salinity 2000, 4000 and 6000 ppm in irrigation water compared to control, irrespective the effect of magnetization and biofertilization.

Magnetically seawater resulted in an increase in total

Table 4: Effect of magnetized seawater and biofertilization on total chlorophyll and carbohydrates in leaves of *Swietenia macrophylla* during seasons of 2016/2017 and 2017/2018.

Salinity Treatments	Total chlorophyll (A+B) mg/g fresh									
	Nile water	2000	4000	6000	Mean	Nile water	2000	4000	5000	Mean
	First season; 2016/2017					Second season; 2017/2018				
Control	2.89ef	2.74f	2.66f	0.01h	2.07C	2.74fg	2.60gh	2.54hi	0.01j	1.97D
Magnetization	3.57cd	3.12e	2.96ef	0.01h	2.41B	3.16c	2.92de	2.60gh	2.40i	2.77C
Biofertilizer	4.01ab	3.60cd	3.50d	2.30g	3.35A	3.86a	3.44b	2.98d	2.56hi	3.21B
Magnetization + biofertilizer	4.24a	3.85bc	3.60cd	2.12g	3.45A	3.98a	3.88a	3.40b	2.78ef	3.51A
Mean	3.68A	3.33B	3.18C	1.11D		3.44A	3.21B	2.88C	1.94D	
Carbohydrate % in stem										
Control	26.50d	12.00i	5.20l	0.01m	10.93D	27.60d	12.58h	5.57m	0.01n	11.44D
Magnetization	28.00c	19.30g	8.90k	0.01m	14.05C	29.10c	20.74f	9.10k	7.80l	16.69C
Biofertilizer	29.30b	20.30f	12.80h	9.22k	17.91B	30.28b	21.30f	13.00gh	11.00i	18.90B
Magnetization + biofertilizer	31.20a	21.00e	13.10h	10.00j	18.83A	32.30a	22.30e	13.20g	10.00j	19.45A
Mean	28.75A	18.15B	10.00C	4.81D		29.82A	19.23B	10.22C	7.20D	

chlorophyll more than control and magnetic device plus biofertilizer produced to maximize the value of total chlorophyll 3.45 mg/gm followed by those received biofertilizer only 3.35 and the intermediate 2.41 mg/gm recorded with the treatment of magnetization only. As for the interaction between salinity levels and treatment of magnetization or biofertilization it can result that the highest mean value of total chlorophyll was 4.24 mg/g fresh weight-related to irrigating the plants with Nile water combined with magnetization plus biofertilization. On the other hand, the seedling irrigated with 2000 or 4000 ppm saline water and treated with magnetization with or without biofertilizer induced increases in total chlorophyll 7.96 and 24.57% over control in the first season.

Total carbohydrates (%)

As shown in table 4 it can be concluded that total carbohydrates in stem extremely significantly diminished because of the irrigation by different saline water levels compared with control and there were a linear negative correlation between the salinity levels and the reduction in total carbohydrate irrespective the effect of both magnetization and biofertilization. Magnetic water with adding biofertilizer produced significantly the highest mean values of total carbohydrates 18.83 and 19.45% in first and second seasons, respectively followed by those treated with biofertilizer only 17.91 and 18.90% and the intermediate was the obtained from the treatment of magnetized water only since the mean values were 14.05 and 16.69%. While, the control gave the least regardless of the effect of salinity. Regardless the effect of salinity.

The interaction between salinity and the treatments of magnetization and biofertilization the herein results pointed out that the highest values of total carbohydrates revealed in the plants irrigated with Nile water combined with magnetic water plus biofertilizer and the least value recorded with those irrigated with 4000 or 6000 ppm combined with non-magnetic water or non-biofertilizer.

It is worthily noticeable from the obtained results of table 4 that both magnetic water and biofertilizer improved the status of total carbohydrate in the stem of seedling irrigated with high salinity.

The former obtained results of total chlorophyll and carbohydrates were in the same line of Alssefat (2006) on *Khaya senegalensis* showed that salinity stress reduced total carbohydrate in leaves, stems and roots, also, magnetic field enhanced total chlorophyll and total carbohydrate in agreement with Al-Khazan and Abdullatif (2009) on Jojoba and Vladimir (2017) on lettuce, all of them declared that plants irrigated with magnetized water significant increases in total chlorophyll and total carbohydrate compared to control treatment.

Concerning the effect of biofertilizer the current results were harmony with Shanan and Higazy (2009) on *Matthiola incana* plants, Grzesik *et al.,* (2017) on (*Salix viminalis* L.), Anand *et al.,* (2015) on Maize crop showed a significant increase in Chlorophyll a. and Mohsen *et al.,* (2016) on lettuce plants all of them stated that all different biofertilizer treatments considerably increased chlorophyll content and total carbohydrate.

As shown in table 5 it can be concluded that irrigation the plants with diluted sea water at levels of 2000, 4000, 5000 and 6000 ppm saline water resulted in significantly reduction in N, P, K% leaves content compared to control meaning that the salinity counteracted or reduced the absorption of these element consequently decreased in leaves specially at high level of salinity 6000 where the reduction equal 60.89, 61.7 and 59.63% in N, P, K% leaves content respectively. The previous obtained results of salinity coincided with many researches such as Viegas *et al.,* (2004) on *Prosopis juliflora*, Alssefat (2006) on *Khaya senegalensis*, Leyanes (2012) on *Jatropha curcas* L., all of them emphasized that salinity decreased N, P and K content in leaves.

Magnetized diluted sea water treatment illustrated that magnetic with or without biofertilizer raised up the leaves content of N, P, K% in particular the percentages of the increased equilibrium 78.22, 95.83 and 69.89% respectively more than control in seedlings exposed to magnetized saline water irrigation plus biofertilization. The results of second season tended to the same trended of those obtained in first one.

The obtained results indicated also that separately magnetization of biofertilization alone treatments associated in exceeding the absorption of each N, P and K, this fact exhibited in both seasons. The interaction between salinity and magnetization with or without biofertilizaion declared that the highest values of N, P, K% 4.93, 0.66 and 2% respectively recorded with the plants irrigated with fresh water combined with magnetic plus biofertilizer whist the lower values of 2.8, 0.25 and 1.20% appeared with irrigating the plants with saline water at levels 4000 ppm combined with non magnetic or non biofertilizer, on the other hand saline water irrigation at levels of 2000 ppm combined with magnetic sea water alone or with adding biofertilization induced. Increased N, P and k% content more than those irrigated with fresh water and did not exposed to magnetization or biofertilization. the aforementioned obtained results of influencing exposed to magnetic field were in harmony with the finding of many scientists such as Maheshwari and Grewal (2009) on tomato, Abou El-Yazied *et al.,*

Table 5: Average of nitrogen, phosphorus and potassium (%) of *Swietenia macrophylla* leaves content as affected by magnetizing seawater treatment and biofertilization during 2016/2017 and 2017/2018.

Salinity Treatments	N% in leaves									
	Nile water	2000	4000	6000	Mean	Nile water	2000	4000	5000	Mean
	First season; 2016/2017					Second season; 2017/2018				
Control	3.20ef	3.00f	2.80f	0.01g	2.25D	3.33e-h	3.10f-h	2.88gh	0.01i	2.33D
Magnetization	3.64de	4.32bc	3.00f	0.01g	2.74C	3.74de	4.40c	3.10f-h	2.80h	3.51C
Biofertilizer	4.40a-c	4.00cd	3.20ef	3.10ef	3.67B	4.44c	4.20cd	3.55ef	3.20e-h	3.84B
Magnetization + Biofertilizer	4.93a	4.60ab	3.30ef	3.20ef	4.01A	5.00a	4.71b	3.41e-g	3.33e-h	4.11A
Mean	4.04A	3.98A	3.08B	1.58C		4.13A	4.10A	3.23B	2.33C	
P % in leaves										
Control	0.35c-e	0.33c-e	0.25e	0.01f	0.24C	0.40d	0.36de	0.30e	0.01f	0.27D
Magnetization	0.36cd	0.50b	0.32de	0.01f	0.30B	0.40d	0.42cd	0.35de	0.30e	0.37C
Biofertilizer	0.52b	0.50b	0.43bc	0.35c-e	0.45A	0.52b	0.50b	0.48bc	0.40d	0.48B
Magnetization + Biofertilizer	0.66a	0.50b	0.38cd	0.34c-e	0.47A	0.62a	0.60a	0.50b	0.40d	0.53A
Mean	0.47A	0.46A	0.35B	0.18C		0.49A	0.47A	0.41B	0.28C	
K % in leaves										
Control	1.30d	1.21de	1.20de	0.01f	0.93D	1.43de	1.30ef	1.33ef	0.01g	1.02D
Magnetization	1.44c	1.20de	1.15e	0.01f	0.95C	1.55d	1.40de	1.30ef	1.20f	1.36C
Biofertilizer	1.70b	1.75b	1.44c	1.30d	1.55A	1.73c	1.90ab	1.55d	1.33ef	1.63B
Magnetization + Biofertilizer	2.00a	1.55c	1.45c	1.30d	1.58A	2.00a	1.77bc	1.55d	1.50d	1.71A
Mean	1.61A	1.43B	1.31C	0.65C		1.68A	1.59B	1.43C	1.01D	

(2012) on *Lycopersicon esculentum*,Yanju Gao *et al.,* (2017) on Cotton they stated that magnetically treatments increased N, P and K% uptake and translocation. The former obtained results of the effect of biofertlization on mineral content were similar to the obtained by Mohsen *et al.,* (2016) and Grzesik *et al.,* (2017) since reported that adding of different concentrations of cyanobacteria extracts (Anabaena oryzae and Nostoc muscorum) for lettuce plants, increased in total N, P and K in plants.

Sodium (%) in leaves

Data presented in table 6 obviously cleared that irrigation with saline water progressively increased Na% in leaves with exceeding the concentrations of salinity. As regards, the influence of magnetized treated water it can be noticed that magnetic water singly or plus biofertilizer resulted in a decreasing Na^+% content in leaves of *Swietenia macrophylla* compared to control. But the mixture of biofrtilizer and magnetically treated water with the most beneficial reducing Na^+% content.

The obtained results of the interaction cleared that at any level of salinity in irrigation water treatment of magnetized device or biofertilizatation reduced the absorption of sodium from root zoon and the positive effect was more pronounced with high levels of salinity.

Meaning that magnetization with or without biofertilizer prevented or lessed the uptake of Na^+% consequently it reduced in leaves. The above mentioned obtained results were in harmony with (Takachenko, 1995) who reported that Na reduction may be due to the efficiency of the magnetic system on eliminating the cohesion between mineral particles thus prevents salt accumulation leading to reduction in the absorption Na^+, Garcia *et al.,* (2007) on maize plants showed that the increasing of soil salinity by irrigation with saline water resulted in increased the sodium content.

Maheshwari and Grewal (2009) suggested that the

Table 6: Average of Sodium in leaves content of *Swietenia macrophylla* as affected by magnetizing seawater treatment and biofertilization during of 2016/2017 and 2017/2018.seasons.

Salinity Treatments	Na %									
	control	2000	4000	6000	Mean	Control	2000	4000	5000	Mean
	First season; 2016/2017					Second season; 2017/2018				
Control	0.70g	1.70c	2.12ab	0.01h	1.51A	0.80h	1.70e	2.10a	0.01j	1.53A
Magnetization	0.65g	1.55d	2.00b	0.01h	1.40B	0.65i	1.30g	1.85c	2.15a	1.49A
Biofertilizer	0.61g	1.25e	1.68cd	2.25a	1.45AB	0.63i	1.40f	1.80cd	2.10a	1.48A
Magnetization + biofertilizer	0.60g	1.00f	1.60cd	2.15a	1.34C	0.60i	1.25g	1.75de	2.00b	1.40B
Mean	0.64D	1.38B	1.85A	2.20A		0.67D	1.41C	1.88B	2.08A	

Table 7: Ratio K/Na content in leaves of *Swietenia macrophylla* as affected by magnetizing seawater treatment and biofertilization during of 2016/2017 and 2017/2018 seasons.

Salinity Treatments	K^+/Na^+ ratio									
	Nile water	2000	4000	6000	Mean	Nile water	2000	4000	5000	Mean
	First season; 2017					Second season; 2018				
Control	1.86d	0.71h-j	0.57j	1.00f	1.04D	1.79d	0.76hi	0.63ij	1.00fg	1.06D
Magnetization	2.22c	0.77g-i	0.58j	1.00f	1.19C	2.38c	1.08f	0.70ij	0.56j	1.18C
Biofertilizer	2.79b	1.40e	0.86f-h	0.58j	1.41B	2.75b	1.36e	0.86gh	0.63ij	1.40B
Magnetization + Biofertilizer	3.33a	1.55e	0.91fg	0.60ij	1.60A	3.13a	1.42e	0.89gh	0.75hi	1.55A
Mean	2.55A	1.11B	0.73C	0.59C		2.51A	1.15B	0.77C	0.65C	

magnetic water may be assisting to reduce the Na toxicity at the cell level by detoxification of Na^+, either by restricting the entry of Na^+ at membrane level or by reduced absorption of Na^+ by plant roots. Zlotopolski (2017) showed that MWT reduced-sodium concentrations in soil by leaching it below root zones. This could explain why plants treated by MWT had less leaf sodium levels compared to non-MWT.

Fernandes *et al.*, (1993) explained that the effect of cyanobacteria in decreasing soil salinity could be due to cyanobacteria exudates which remove Na^+ from aqueous medium by bio sorption. Mahmoud *et al.*, (2007) reported that soil inoculation with cyanobacteria led to a significant reduction in electric conductivity (EC) in sandy soil, Al-Sherif *et al.*, (2015) reported that soil EC was highly significantly reduced by inoculation with a mixed culture of cyanobacteria suspension, Nostoc minutum and Anabaena spiroides.

Ratio potassium and sodium content in leaves

Table 7 cleared that the ratio of K^+ : Na^+ significantly diminished with the increase of salinity, due to the increasing Na consequently lessen the absorption of k regardless of the effect of magnetized seawater and using biofertilizer treatment. In this respect, the obtained results indicated in both seasons that treatment of both magnetize field and biofertilizer resulted in increases in the ratio K^+ : Na^+, in addition, using magnetized treatment with adding biofertilizer produced the highest ratio K^+ : Na^+ followed by the treatment of biofertilizer alone. The remarkable increased in ratio due to improved the uptake of K^+ and reduced Na^+ element led to K^+ content raised up more than Na^+, it may be because of magnetization system and biofertilization prevented or lessen the absorption of Na^+ and increased K^+, in addition, the selectivity of permeability cell wall which passed potassium more than sodium.

The interaction between salinity and both magnetization and fertilization it is cleared that the highest ratio was related to magnetization plus biofertilizer combined with irrigated by Nile water and the lowest value revealed with 4000 ppm saline water combined with control (non-magnetic). These results emphasized that the magnetic system adding biofertilizer or without ameliorated the ratio between K^+ : Na^+ even though they irrigated by saline water. These obtained results confirmed in both seasons.

These results may be due to the effect of conditioner water on removal salts out of the Na^+ ion for K^+ absorption leading to an increasing K^+/Na^+ ratio, similar results obtained by Khattab *et al.*, (2000) on gladulus plants. The increases K^+/Na^+ ratio because of treating the plants by biofertilizer may be due to enhancing the synthesis of protein, RNA and DNA formation (Salem, 1999), thus root growth could be increased and uptake of K enhanced consequently and sodium uptake reduced by the membranes channels of cell walls in accordance with the finding of (Singh, 2000) on *Eucalyptus camaldulensis*. Mostafa (2002) on *Calendula offiecianalis* stated that the magnetic treating of saline water was the most efficient method in increasing K^+ : Na^+ ratio in the leaves. Viegas *et al.*, (2004) found that salinity stress reduced K^+ contents of *Prosopis juliflora* seedlings shoot and reduced K^+: Na^+ ratio in agreement with the herein results. Garcia *et al.*, (2007) on maize plants showed that the increasing of soil salinity by saline water irrigation resulted in increased the reaction K^+ : Na^+ ratio.

References

Abd-El-Dayem, A.M.A. (1988). Physiological studies on some ornamental trees. Ph. D. Thesis, Fac. Agric., Tanta Univ. Kafr El-Sheikh, Egypt: 142-148.

Abou El-Yazied, A. and O. Shalaby, S.M. Khalf and A. El-Satar (2011). Effect of Magnetic Field on Seed Germination and Transplant Growth of Tomato. *Journal of American Science,* **7(12):** p. 306-312.

Abou El-Yazied, A., A.M. El-Gizawy, S.M. Khalf, A. El-Satar and O.A. Shalaby (2012). Effect of Magnetic Field Treatments for Seeds and Irrigation Water as Well as N, P and K Levels on Productivity of Tomato Plants. *Journal of Applied Sciences Research,* **8(4):** 2088-2099, 2012. ISSN

1819-544.

Ali, E.F., A.F.A. Ebeid, R.M.M. Sayed and H.H. Hmmad (2011). Response of some wood trees seedlings to saline irrigation water. Prac. 5th Conference of Young Scientist Fac. *Of Agric. Assiut Univ. May,* **8:** 302-316.

Al-Khazan, M.M. and B.M. Abdullatif (2009). Effect of irrigation with magnetized water on growth, photosynthesis pigments and proline accumulation in jojoba plants (*Simmondsia chinensis* L.) seedlings. *Saudi J. Biol. Sci.,* **16(3):** 107-113.

Al-Sherif, E.A., M.S. Ab El-Hameed, M.A. Mahmoud and H.S. Ahmed (2015). Use of cyanobacteria and organic fertilizer mixture as soil bioremediation. *American-Eurasian J. Agric. Environ. Sci.,* **15:** 794–799.

Alssefat, S.L. (2006). Effect of biofertilization and salinity levels on *Khaya Senegalensis* plants. Ph.D. Department of Ornamental Horticulture. Faculty of Agriculture Cairo University: 28-65.

Anand M., B. Kumar and Dina N. (2015). Cyanobcterial Consortium improvement of Maize Crop. *Int. J. Curr. Microbiol. App. Sci.,* **4(3):** 264-274. ISSN: 2319-7706 Volume4 Numebr3(2015) pP.264-274 http:/www.ijcmas. com.

Barnes, J.D., L. Balaguer, E. Manrique, S. Elvira and A.W. Davison (1992). A reappraisal of the use of DMSO for the extraction and determination of chlorophylls a and b in lichens and higher plants. *Environ. Exp. Bot.,* **32:** 85–100.

Black, C.A. (1982). Methods of soil analysis. Part 2. Chemical and microbiological properties. Second Edition. Amer. Soc. of Agron. Madison, Wisconsin, U.S.A.

Boghdady, M.S. and A.S. Ali (2013). Comparison between effect of Azospirillum brasilense and Anabaena oryzae on growth, yield and anatomical characters of wheat plants. *J. Appl. Sci. Res.,* **9(1):** 627-637.

Borowitzka, L. (1986). In progress in *Phycological Res.,* **4:** Eds Round and Chapman, Bio Press Ltd., pp. 56-243.

De-Souza, A. (2005). Increase of vegetable productivity cultivated under organic conditions and small extensions by pre-sowing magnetic treatment of seeds. Agricultural Research Institute «Jorge Dimitrov», Bayamo, Cuba.

Dubois, M., K.A. Gilles, J.K. Hamilton, P.A. Rebers and F. Smith (1956). Colorimetric methods for determination of sugars and related substances. *Am. Chem. Soc.,* **23:** 351–359.

El-Gaml, M. (2006). Studies on cyanobacteria and their effect on some soil properties. Benha University, Kalubia, MSc. Thesis.

El-Nashawy, S. (1997). Biological report of the analysis of the magnetic treated water of wells for irrigation. Plant Pathol., ARC, Cairo, Egypt.

Fernandes, T.A., V. Iyer and S.K. Apte (1993). Differential responses of nitrogen fixing cyanobacteria to salinity and osmotic stress. *Appl. Environ. Microbial.,* **59:** 899-904.

Garcia, G.D., P.A. Ferreira, G.V. Miranda, J.C. Neves, W.B. Moraes and D.B. Santos (2007). Lea contents of cationic macronutrients and their relationships with sodium in maize plants under saline stress. *IDESIA,* **25:** 93-106.

Grzesik, Z., Romanowska-Duda and H.M. Kalaji (2017). Effectiveness of cyanobacteria and green algae in enhancing the photosynthetic performance and growth of willow (*Salix viminalis* L.) plants under limited synthetic fertilizers application. *Photosynthetica,* **55(3):** 510-521.

Hellal, H.M. (1998). Magnetic techniques. 45, Ahmed Erabi St. Mohandessien, Cairo, Egypt.

Hizayn, M. and A.M.S.A. Qados (2010). Irrigation with magnetized water enhances growth, chemical constituent and yield of chickpea. *Agriculture and Biology Journal of North America,* **1(4):** 671-676.

Holdridge, L.R. (1967). Life Zone Ecology. Tropical Science Center, San Jose, Costarica, Book, P 200-206.

Irri, A. (1976). Laboratory Manual for Physiological Studies on Rice . 3rd ed . (Souchi Youshidu D.A frono, J.H. Cook and K.A. Gomezeds) 17-23 The International Rice Research Institute, Los Banos Phillipines.

Khan, G.S., Z.H. Khan, J. Mran, M.U. Quraishi, S. Yaqoob and S.H. Khan (2009). Effect of salinity on germination and growth of some forest tree species at seedling stage. *A GRIS,* **47(3):** 271 – 279.

Khattab, M., M.G. El-Torky, M.M. Mostafa and M.S. Doaa Reda (2000). Pre treatment of gladiolus cormels to produce commercial yield: 1- effect of GA3, seawater and magnetic system on the growth and corms production. *Alex. J. Agric. Res.,* **45(3):** 181-199.

Klute, A. (1986). Methods of Soil Analysis, part I, 2nd ed, USA: Madison, Wisconsin.

Lamb, F.B. (1966). Mahogany in Tropical America: its ecology and management. University of Michigan Press, Michigan. 220 pp.

Leyanes, D.A., V. Gimeno, V. lida, I. Sima, V. Marta and F. Garica (2012). The tolerance of Jatropha curcas seedlings to NaCl: An ecophysiological analysis. *Plant Physiology and Biochemistry,* **54:** 34–42.

Maheshwari, B.L. and H.S. Grewal (2009). “Magnetic Treatment of Irrigation Water: Its Effects on Vegetable Crop Yield and Water Productivity.” *Agric. Water. Manage.,* **96(8):** 1229-36.

Mahmoud, A.A., Soha S.M. Mostafa, Azza A.M. Abd El-All and A.M. Hegazi (2007). Effect of cyanobacterial inoculation in presence of organic and inorganic amendments on Carrot yield and sandy soil properties under drip irrigation regime. *Egypt. J. Appl. Sci.,* **22(12B):** 716-733.

Meloni, D.A., M.R. Gulotta, C.A. Martínez and M.A. Oliva (2004). The effects of salt stress on growth, nitrate reduction and proline and glycinebetaine accumulation In Prosopis alba. *Brazilian Journal of Plant Physiology,* **16(1):** 39–46.

Mesut, Ç.K., T. Önder, T. Metin and T. Burcu (2010). Phosphorus and humic acid application alleviate salinity stress of pepper seedling. *African Journal of Biotechnology,* **9:** 5845-5851.

Mishra, U. and S. Pabbi (2004). Cyanobacteria: a potential biofertilizer for rice. *Resonance,* **9:** 6–10.

Mohsen, A.A.M., A.S.A. Salama and F.M.A. El-Saadony (2016). The Effect of Foliar Spray with Cyanobacterial Extracts on Growth, Yield and Quality of Lettuce Plants (*Lactuca sativa* L.). *Middle East Journal of Agriculture Research. ISSN,* 2077-4605. **5(01):** Jan.-Mar. 2016. Pages:90-96.

Mostafa, M.M. (2002). Effect of biofertilization, salinity and magnetic technique on the growth of some annual plants. *Alex. J. Agric, Res.,* **47(2):** 151-162.

Munns, R. (2002). Comparative physiology of salt and water stress. *Plant Cell Environ.,* **25:** 239–250.Mura.

Pennington, T.D. (2002). Mahogany carving a future. *Biologist,* **49:** 204 –208.

Piper, C.S. (1950). Soil and Anslysis Inter. SC. Palp, New York, 368 PP.

Pregl, F. (1945). Quantitative organic microanalysis, 4^{th} ed J.A. Churchill, Ltd, London.

Reddy, P.M., P.A. Roger, W. Ventura and I. Watanabe (1986). Blue-green algal treatment and inoculation had no significant effect on rice yield in an acidic wetland soil. Special BGA Issue. *The Philippine Agriculturist,* **69:** 629-632.

Rippka, R., J. Deruelles, J.B. Waterburg, M. Herdman and R.Y. Stanier (1979). Generic assignments, strain histories and properties of pure cultures of cyanobacteria. *J. Gen. Microbial.,* **111:** 1-16.

Rowell, D.L. (1993). Soil Science Methods and Applications. Dept. of Soil Science, Univ. of Reading. Co published in The US with John Willey and Sons Inc., New York. pp: 350.

Rowland, D.L., A.A. Sher and D.L. Marshall (2004). Inter andintra-population variation in seedling performance of Rio Grande cottonwood under low and high salinity. *Canadian Journal of Forest Research,* **34(7):** 1458–1466.

Salem, F. (1999). Cyanobacterial effect on growth and chemical composition of soybean grown under saline conditions. *Amb. Univ. J. Agri. Sci.,* **7:** 433-446.

Sarhan, A.Z., A.M. Abd El-Dayem, A.S. Soliman and S.A. Sherbeeni (2018). Effect of Irrigation Water Salinity and Zinc Fertilization on Growth of Swietenia macrophylla. *J. Plant Production, Mansoura Univ.,* **9(7):** 631 - 635, 2018.

Singh, K. (2000). Seedling growth and mineral composition of Eucalyptus hybrid in light and heavy saline and saline sodic soils. *Indian Forester,* **126:** 376-381.

Shanan, N.T. and A.M. Higazy (2009). Integrated biofertilization management and cyanobacteria application to improve growth and flower quality of Matthiola incana. *J. Agr. Biol. Sci.,* **5:** 1162-1168.

Snedecor, G.W. and W.G. Cochran (1980). Statistical Methods. 6th The Iowa St. Univ., Press. Aines, U.S.A.

Soliman, A. S. Sh., A. El- Feky and E. Darwish (2015). Alleviation of salts tress on *Moringa peregrine* using foliar application of Nano fertilizers. *Journal of Horticulture Forestry,* **7(2):** 36–47.

Taha, B., A. Soha, E. Khalil and Ashraf, M. Khalil (2011). Magnetic treatments of *Capsicum Annuum* L. grown under saline irrigation conditions. *Journal of Applied Sciences Research,* **7(11):** 1558- 1568.

Takachenko, Y. (1995). The application of magnetic technology in agriculture (Magnetizer). Abu-Dhabi, UAE, Fax: 781265.

Tester, M. and R. Davenport (2003). Na+ tolerance and Na+ transport in higher plants. *Ann. Bot.,* **91:** 503-527.

Vaishampayan, A., R.P. Sinha, D.P. Hader, T. Dey, A.K. Gupta, U. Bhan and A.L. Rao (2001). Cyanobacterial biofertilizers in rice agriculture. *Bot. Rev.,* **6:** 453–516.

Viegas, R.A., M.J. Fausta, J.E. Oueiroz and I.M.A. Rocha (2004). Growth andtotal N content of Prosopis juliflora (SW) D.C. are stimulated by low NaCl levels. *Brazilian of Plant Physiology,* **16(11):** 65-68.

Vladimir, Z. (2017). Magnetic Treatment Reduces Water Usage in Irrigation Without Negatively Impacting Yield, Photosynthesis and Nutrient Uptake in Lettuce. *International Journal of Applied Agricultural Sciences,* **3(5):** 117-122http://www.sciencepublishinggroup.com/j/ijaas doi: 10. 11648/j. ijaas. 20170305.13ISSN:2469-7877 (Print); ISSN: 2469-7885 (Online).

Yanju, Gao, Yanfei Sun, Ruixi Zhang and Guixin Chu (2017). Effects of Magnetic Water Irrigation on the Growth, N Uptake and Antioxidant Enzyme Activities of Cotton seedlings. *Journal of Agricultural Science and Technology,* **B7:** 25-33.

Zlotopolski, V. (2017). The Impact of magnetic water treatment on salt distribution in a large unsaturated soil column. International Soil and Water Conservation Research. http://dx.doi.org/10.1016/j. iswcr.2017.05.009.

Zulpa, G., M.C. Zaccaro, F. Boccazzi, J.L. Parada and M. Storni (2003). Bioactivity of intra and extracellular substances from cyanobacteria and lactic acid bacteria on "wood blue stain" fungi. *Biol. Control.,* **27:** 345-358.