Menoufia J. Soil Sci.,Vol. 5 February (2020): 19 - 31

IMPACT OF NFERTILIZER RATE ON BARELY (HORDUM VULGARE) IRRIGATED WITH MAGNETIZED AND NON-MAGNETIZED SALINE WATER WITH APPLICATIONOF ^{15}N STABLE ISOTOPE

A. A. Moursy and A. H. El-Kholy

Atomic Energy Authority, Nuclear Research Center, Soil and Water Research Department, Abou-Zaabl, 13759, Egypt

Received: Nov. 23 , 2019 Accepted: Dec. 8 , 2019

ABSTRACT: ***The experiment was conducted at Soil and Water Research Department Greenhouse, was carried out to study the effect of different levels of salinity stress on the barely crop also Study the effect of the water magnetization to reduce salinity effect and ^{15}N in plant parts. Lowest grain yield of 11.68 g pot^{-1} by $M_0S_2N_0$. This decrease in grain yield was by the low N fertilization and the salinity stress. Grain yield was 38.80 g pot^{-1} ($M_0S_2N_4$) with an increase averaging 232.2%. The lowest straw dry matter yield was 10.60 g pot^{-1} given by $M_0S_3N_0$. Plants werfaced difficulty to absorb N because of salinity. The highest straw yield was 26.40 g pot^{-1} ($M_1S_0N_4$) with 149.1%. The highest straw N uptake was 197.9 by M1N4S0 with 343.7%. The lowest N uptake in grains was 117.9 g pot^{-1} by $M_0S_1N_3$. The highest grains N uptake was 372.9 g pot^{-1} by M_0 S_2N_2 216.3% increse N recovery by straw ranged was 0.11 to 7.76 g pot^{-1} due to $M_0S_0N_3$ and $M_1S_2N_1$, respectively. The main effect of magnetization was an increase due to M_1. The main effect of salinity show an increase in NR when the salinity was in medium rates. N recovery by grains ranged from 0.65 to 25.14 g pot^{-1} due to $M_0S_0N_1$ and $M_1S_1N_1$, respectively.***

Key word: *^{15}Nitrogen, salinity, magnetized water, barely crop.*

INTRODUCTION

Magnetic water treatment is one such area, and the magnetic field applications have been known for centuries (Colic and Morse, 1999) Michael Faraday introduced the concept of induction as early as 1830, stating that when a magnetic field flux is crosses by flow ions or a conductive material, electrical current is induced. Although magnetic field applications were rapidly pursued in order to prove Faraday's claim, attention by researchers and industrialists worldwide was still lacking (Zaidi *et al.,* 2014). Some of the earlier studies showed that, when water is exposed to a magnetic field, the magnetization of water changes its properties including optics, electromagnetism, thermodynamics and mechanics, affecting the dielectric constant, viscosity, surface tension, freezing and boiling points and electric conductivity. Thus, magnetized water has extensive applications in industry, agriculture and medicine (Teixeira da Silva and Dobránszki, 2016). Claims have been made that magnetic fields change the physiochemical properties of water, or prepared laboratory solutions (Hozayn *et al.,* 2016).

Salinity is aproblem in arid and semi-arid regions, such as Egypt. About 33% of the cultivated land, in Egypt are saline. Such salinity is mainly due to low precipitation (<25 mm annual rainfall), high temperature, high surface evaporation (1500- 2400 mm/year), poor drainage irrigation with low quality and high water table Salt stress generally leads to a reduction in crop groth and yield (Parida and Das, 2005). Irrigated agriculture depends on adequate, high-

quality water supplies. As the level of salt increases in irrigation under the quality of water for plant growth decreases. All irrigation waters contain some salt. In many areas, good quality (low salt and low sodium) water is not available for irrigation; consequently waters containing high levels of salt must be used.

Nitrogen is an essential macronutrient for plants. The increasingly severe environmental problems caused by N fertilizer application urge alleviation of N fertilizer dependence in fertilization.

Barley is one of the most important cereal crops in Egypt. it occupied a very important position in the Egyptian cropping system for its moderate salt tolerance, and ability to grow over a wide range of environmental stresses (Abd El-Hady, 2007). It can tolerate chemical pollutants and give an economic yield under adverse conditions (Ayman, 2015). is mainly used for malting and subsequent beer brewing (Gupta *et al.,* 2010). Low protein content (9.5-11.5%) and explicit limits for contents of microorganisms and toxins are desired (FAO, 2009). For this reason, investigations on the relationship of N-input with pathogen contamination are highly relevant to secure product quality.

The presentstudy aims at assessing (i) study the effect of salinity on the plant. (ii) the effect of the magnetized to reduce salinity. (iii) hazards transportation of ^{15}N by plant parts. (iv) the effect of water magnetization on N uptake by plant.

MATERIALS AND METHODS

The experiment was conducted at Soil and Water Research Department Greenhouse, Nuclear research Center, Atomic Energy Authority, Abou-Zaabal, Egypt

The soil used in the study was sand. The experimental design was a split-split plot design involves 3 factors with three replicates. The factors were as follows:

Factor M: Two magnetized water treatments as follows:

(i) Non magnetized water (M_0) and (ii) magnetized water (M_1)

Factor S: Four salinity stress treatments as follows:

(i) Without salinity stress (S_0), (ii) water of 3 dS m^{-1} (S_1), (iii) water of 6 dS m^{-1} (S_2) and (iv) water of 9 dS m^{-1}(S_3).

Factor N: FiveN fertilization treatments % of100 mgNkg^{-1} as follows:

(i) without N fertilization (N_0), (ii) 25mgN kg (N_1) (iii) 50 mgNkg from the recommended rate (N_2), (iv) 75mgNkg from the recommended rate (N_3) and (v) 100% from the recommended rate (N_4).

Nitrogen-fertilizer was applied and thoroughly mixed with soil in the pots experiment in the form of ^{15}N-Labeled ammonium sulfate with 2% ^{15}N atom excess at four weeks after seeding.

PVC pots with dimensions of 25 cm diameter and capacity of 10 kg pot^{-1} were used in the study.

The soil was air-dried, crushed, sieved throw 0.5 cm sieve. Data of physical and chemical properties of the soil used in the study are shown in Table 1.

Barly (Hordum Vulgare) provided by Field Crops Research Institute was seeded at 5seeds per pot. The saline water: wer sea water were sea water mixed with fresh water magnetization was with power of 50 m Tesla. The plants were irrigated during the growth season. Methods of analysis: Chemical and physical analysis of soil was carried out according to Carter and Gregorish (2008), Soltanpour (1985) and Estefan *et al.* (2013). The $^{15}N/^{14}N$ ratio was determined by emission spectrometry ^{15}N-analyzer (Model NOI-6PC) following the description of IAEA (2001).

Table 1: Main properties of soil of the experimental field of the current study.

pH (1:2.5)	EC 'pe'* (dS m^{-1})	$CaCO_3$ (g kg^{-1})	Organic matter (gkg^{-1})	Saturation % (SP)
7.23	0.37	0.0	0.3	12.47
Soluble Ions ($mmol_c$ L^{-1})				
Na^+	0.32	CO_3^{2-}	0.00	
K^+	0.09	HCO^{3-}	0.88	
Ca^{2+}	1.20	Cl^-	1.25	
Mg^{2+}	1.00	SO_4^{2-}	0.53	
Available nutrients *(mg kg^{-1})				
N	P	K	Fe	Mn	Zn	Cu
5.0	2.0	2.2	25.8	0.5	1.4	1.4
Total nutrients (g kg^{-1})						
N	P	K	Fe	Mn	Zn	Cu
0.30	0.04	1.00	2.20	0.01	0.10	0.20
Particle size distribution (%)						
Sand	Silt	Clay	Texture			
98.0	2.0	0.0	Sand			

*Extracts of: KCl for N, NH_4HCO_3-DTPA for P,K, Fe, Mn, Zn and Cu; Pe: paste extract

RESULTS AND DISCUSSION

Straw dry matter yield:

The highest straw dry matter yield was 26.40 g pot^{-1} ($M_1S_0N_4$) with on increases averaging 149.1%. The lowest straw dry matter yield was 10.60 g pot^{-1} given by $M_0S_3N_0$. (Table 2). The low Yield was due to salinity stress. Plants were not able to absorb nitrogen from the soil because of salinity stress. The main effect of magnetization shows a $M_1>M_0$ with an increase averaging 22.9% due to M_1 but there was an interaction caused by salinity and N fertilization. Under conditions of highest N the magnetized were passed the non magnetized alighty under conditions of S2 salinity level the magnetized did not aurpass the non magnetized.

The main effect of salinity shows a treated of $S_0>S_2>S_3>S_1$ with an a decreases averaging 10.8, 0.3 and 14.5% due to S_1, S_2 and S_3 respectively but there was an interaction caused by magnetization and N fertilization. Under conditions of non-magnetized treatment the patern was $S_2>S_3>S_0>S_1$ but under conditions of the magnetized the patern was $S_0>S_3>S_1>S_2$.

The N fertilization main effect shows a pattern of N4>N3>N2>N1>N0 with increases averaging 11.5, 32.2, 42.9 and 48.8 % due to N4, N3, N2 and N1 respectively there was an interaction caused by magnetization .under no magnetization both N3 and N4 were not different from each other and the the pattern was $N4=N3>N_2>N_1>N_0$.

Table 2: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on straw dry matter yield (g pot^{-1}).

Magnetization (M)	Salinity (S)	Nitrogen fertilization (N)					mean
		N_0	N_1	N_2	N_3	N_4	
Non Magnetized	S_0	10.80	12.57	12.46	14.21	23.01	14.61
	S_1	11.98	13.86	13.92	16.38	13.00	13.82
	S_2	14.70	14.62	18.61	19.98	22.75	18.13
	S_3	10.60	13.24	16.74	17.55	18.75	15.37
	mean	12.01	13.57	15.43	17.03	19.38	15.48
Magnetized	S_0	12.60	19.65	23.24	24.86	26.40	21.35
	S_1	19.82	14.40	17.65	20.78	18.64	18.25
	S_2	14.57	17.11	19.70	18.16	19.10	17.72
	S_3	13.66	15.68	21.34	23.33	20.02	18.80
	mean	15.16	16.71	20.48	21.78	21.04	19.03
G. mean		13.58	15.14	17.95	19.40	20.21	
Mean of Salinity (S)							
	S_0	11.70	16.11	17.85	19.54	24.70	17.98
	S_1	15.90	14.13	15.78	18.58	15.82	16.04
	S_2	14.63	15.86	19.15	19.07	20.92	17.93
	S_3	12.12	14.46	19.04	20.44	19.38	17.09

LSD 0.05: M: 0.3 ; S: 0.4 ; N: 0.47 ; MS: 0.6 ; MN: 0.67 ; SN: 0.95 ; MSN: 1.3

The beneficial effects of magnetic treatment have also been reported on germination percentages of lower seeds (Matwijczuk *et al.,* 2012); maize root growth (Turker *et al.,* 2007), element uptake by same vegetables (Maheshwari and Grewal, 2009), and yield (Selim and El-Nady, 2011).

Grains yield:

The lowest grain yield was 11.68 g pot^{-1} by M_0S_2N0. (Table 3). The hight grain yield was 38.80 g pot^{-1} by $M_0S_2N_4$ with an increase averaging 232.2%.

The main effect of magnetization shows the treatment of $M_1>M_0$ with an increases averaging 13.7% due to M_1 but there was an interaction caused by salinity and N fertilization. Under conditions of N0 or N1 the M1 awrpassed M0 : under N treatment. Under conditions of S2 salinity M0 was greeter than M0. The main effect of salinity shows the treatment of $S_2>S_0=S_3=S_1$ with an increase averaging 17.0% due to S_2 and a decrease averaging 4.1 and 0.8 % due to S_1 and S_3 respectively there was an interaction caused by magnetization where the pattern showed differences among all salinity levels under magnetization and N fertilization.. Under conditions of N_2, N_3 and N_4 the highest grain yield was given by S_2.

The N fertilization main effect shows the treatment of $N_4>N_3>N_2>N_1>N_0$ with an increases averaging 5.7, 28.7, 32.1 and 36.5 % due to N_1, N_2, N_3 and N_4 There was an interaction caused by the magnetized water and salinity. Under conditions of non-magnetization the patern was $N_4>N_2>N_3>N_1>N_0$.. Under conditions of magnetization the pattern was $N_3>N_4>N_2>N_0>N_1$.G rain yield increased when nitrogen was added to the soil as a Fertilizer form. Studies, (Tanaka *et al.,* 2010). Other studies studies employed magnetized water and found that it can improve water productivity and crop yield (Maheshwari and Grewal, 2009).

Table 3: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on grain dry matter yield (g pot^{-1}).

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)					mean
		N_0	N_1	N_2	N_3	N_4	
Non Magnetized	S_0	14.64	15.18	14.02	17.82	28.55	18.05
	S_1	12.55	12.62	18.16	15.78	18.70	15.56
	S_2	11.68	20.90	31.57	26.03	38.80	23.80
	S_3	12.43	19.63	20.02	21.29	14.50	17.57
	mean	12.82	17.08	20.96	20.23	22.63	18.74
Magnetized	S_0	14.10	22.25	24.40	21.21	22.26	20.84
	S_1	27.66	18.06	18.76	22.34	21.86	21.74
	S_2	20.85	15.98	22.17	24.95	24.55	21.70
	S_3	18.95	15.81	21.92	26.15	22.21	21.01
	mean	20.40	18.02	21.81	23.66	22.72	21.32
G. mean		16.61	17.55	21.38	21.95	22.68	
Mean of Salinity (S)							
	S_0	14.37	18.71	19.23	19.52	25.40	19.45
	S_1	20.10	15.34	18.46	19.06	20.28	18.65
	S_2	16.27	18.43	26.87	25.50	26.67	22.75
	S_3	15.70	17.72	20.97	23.72	18.35	19.29

LSD 0.05: M: 0.54 ; S: 0.76 ; N: 0.85 ; MS: 1.08 ; MN:1.2 ; SN: 1.7 ; MSN:2.4

N uptake in straw:

The lowest N uptake in straw was given by the untreated treatment ($M_0S_0N_0$) (Table 4).. The highest straw N uptake of 197.9 was by M1N0S4 with increase of 343.7%. (Table 4)

The main effect of magnetization shows the $M_0>M_1$ with a decrease 0.22% due to M1 but there was an interaction caused by salinity. Under conditions s0 or s1 the pattern was m1> M0, but under conditions of other salinity leavels it was $M_1<M_0$. Under conditions of N0 , N1.

The main effect of salinity shows a pattern of $S_2>S_0>S_1>S_3$ with an increase about 17.7% due to S_2 and decreases averaging 11.7 and 25.1 % due to S_1 and S_3 respectively there was an interaction caused by magnetization and N fertilization. Under conditions of no-magnetization the pattern was $S_2>S_3>S_1>S_0$, but under conditions of magnetization the pattern was $S_0>S_2>S_1>S_3$. Under conditions of any N1 or N3 rate the pattern agrees with that of the main effect under other N treatments the pattern disagreed that of the main treatment.

The N fertilization main effect shows the treatment of $N_3>N_4>N_2>N_1>N_0$ with an increases averaging 18.7, 31.6, 47.2 and 44.9 % due to N_1, N_2, N_3 and N_4 respectively There was an interaction caused by the magnetized water and salinity under conditions of non-magnetization the pattern was $N_4>N_3>N_2>N_1>N_0$ respectively. Under conditions of magnetized the pattern was $N_3>N_4>N_1>N_2>N_0$. Under conditions of any salinity stress treatment the pattern was disagree with the main effect.

Magnetization gave positive effect against (Maheshwari and Grewal, 2009), and caused mobility of nutrients from fertilizers (Hozayn and Abdul Qados, 2010), water holding capacity of soil (Al-Khazan *et al.,* 2011); and decreased soil pH. (Chang and Weng, 2006).

Table 4: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on N uptake in straw dry matter yield g pot^{-1}.

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)					Mean
		N_0	N_1	N_2	N_3	N_4	
Non Magnetized	S_0	44.6	59.1	77.5	60.9	148.8	78.2
	S_1	67.7	88.2	73.5	86.8	77.1	78.6
	S_2	97.3	88.5	146.5	162.4	127.4	124.4
	S_3	53.2	73.2	96.6	96.7	79.5	79.8
	mean	65.7	77.2	98.5	101.6	108.2	90.3
Magnetized	S_0	75.7	97.1	93.5	136.5	197.9	108.1
	S_1	93.6	94.4	76.5	93.2	83.5	88.2
	S_2	73.8	111.9	94.5	101.7	93.6	95.1
	S_3	56.1	53.7	81.1	88.9	65.8	69.1
	mean	74.8	89.3	86.4	105.0	95.2	90.1
G. mean		70.2	83.3	92.4	103.3	101.7	
Mean of Salinity (S)							
	S_0	60.2	78.1	85.5	98.7	143.3	93.2
	S_1	80.7	91.3	75.0	90.0	80.3	83.4
	S_2	85.6	100.2	120.5	132.0	110.5	109.7
	S_3	54.6	63.4	88.9	92.8	72.6	74.5

LSD 0.05: M: 0.98 ; S: 1.4 ; N: 1.56 ; MS: 1.97 ; MN:2.2 ; SN: 3.27 ; MSN: 4.4

N uptake in grains:

Data in Table 5 Show that the lowest N uptake of 117.9 g pot^{-1} by $M_0S_1N_3$. The highest grains N uptake was 372.9 g pot^{-1} in grains was by M_0 S_2N_2 with an increase about 216.3%. This high N uptake was given because of the medium N fertilizer. The main effect of magnetization shows a pattern of $M_1>M_0$ with a increases about 20.2% due to M_1 but there was an interaction caused by salinity and N fertilization. Under conditions of N4 the difference between M1 and M0was very slight, but under conditions of other N treatments M1 surpased M0 concederably. Under conditions of S0 and S2 the pattern was $M_0>M_1$..The main effect of salinity shows a pattern of $S_2>S_3>S_0>S1$ with an increase about 141.1, 2.7% due to S_2 and S3 and a decrease about 11.0 % due to S_1 There was an interaction caused by the magnetization fertilization. under no magnetization the pattern was $S_2>S_3>S_0>S1_{,.}$ Under conditions of N4 the pattern was N1>N2>N0>N3 under N0 the pattern was N1> N2 . N3> N0.The N fertilization main effect shows the treatment of $N_3>N_4>N_2>N_0>N_1$ with an increases averaging 28.1, 41.2 and 29.6 % due to N_2, N_3 and N_4 respectively and a decreases about 4.9% due to N_1 under no magnetization the pattern was $N_4>N_3>N_2>N_1>N_0$.Under magnetization the pattern was $N_3>N_2>N_4>N_0>N_1$. Under conditions of S3 the pattern was N3> N2 > N4 >N1 >N0. Under S3 it wasN3>N2>N1>N0.

Table 5: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on N uptake in grains (mg pot^{-1}).

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)					mean
		N_0	N_1	N_2	N_3	N_4	
Non Magnetized	S_0	163.5	125.5	196.1	237.3	364.5	217.4
	S_1	193.8	139.9	195.3	117.9	200.1	169.4
	S_2	161.1	216.7	372.9	372.1	311.1	286.8
	S_3	139.0	246.6	253.2	310.5	175.3	224.9
	mean	164.3	182.2	254.3	259.4	262.7	224.6
Magnetized	S_0	173.7	269.3	356.2	261.1	267.0	265.4
	S_1	320.5	182.5	187.7	338.1	272.3	260.2
	S_2	274.8	216.0	265.0	357.4	303.4	283.3
	S_3	238.3	190.1	305.6	356.5	264.6	271
	mean	251.8	214.5	278.6	328.3	276.8	270.0
G. mean		208.1	198.3	266.5	293.9	269.8	
Mean of Salinity (S)							
	S_0	168.6	197.4	276.1	249.2	315.7	241.4
	S_1	257.1	161.2	191.5	228.0	336.2	214.8
	S_2	217.9	216.3	318.9	364.8	307.2	285.0
	S_3	188.6	218.4	279.4	333.5	219.9	247.9

LSD 0.05: M: 2.6 ; S: 3.7 ; N: 4.1 ; MS: 5.2 ; MN: 5.8 ; SN: 8.26 ; MSN: 11.7

Na uptake in straw: (Table 6)

The lowest Na uptake in straw was 114.3 g pot^{-1} by $M_0S_0N_0$. The highest Na uptake in straw 580.1 g pot^{-1} by $M_1S_0N_4$ with increase of 407.5%. The main effect of magnetization shows $M_1>M_0$ with an increase 62.1% due to M_1. Under conditions of N4 the increase of M1 over M0 was not very high. The main effect of salinity shows the treatment of $S_3>S_2>S_0>S_1$ with an increases averaging 5.6 and 13.6% due to S_2 and S_3 and respectively and a decrease 8.9% due to S_1. Under conditions of no magnetization the pattern was $S_2>S_3>S_1>S_0$, Under conditions of magnetization the pattern was $S_3>S_0>S_1>S_2$.. The N fertilization main effect shows the treatment of $N_4>N_3>N_2>N_1>N_0$ with an increases averaging 10.8, 42.9, 44.5 and 11.9% due to N1, N2, N3 and N4 respectively.. With condition of no-magnetization the pattern agres with the main effect. Under conditions of magnetized it was $N_4>N_2>N_3>N_1>N_0$. Under conditions ofS3 or S1 the N3 treatment showed hight N uptake followed by N4.

Table 6: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on Na uptake in strawm g pot^{-1}.

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)					mean
		N_0	N_1	N_2	N_3	N_4	
Non Magnetized	S_0	114.3	181.2	188.9	191.9	304.2	196.1
	S_1	149.7	182.7	189.8	270.5	172.2	193.0
	S_2	266.1	263.2	317.2	336.1	383.5	313.2
	S_3	177.9	209.4	371.6	317.9	305.6	276.5
	mean	177.0	209.1	266.9	279.1	291.4	244.7
Magnetized	S_0	223.9	414.3	491.4	436.1	580.1	429.1
	S_1	384.8	287.6	362.8	439.3	407.7	376.4
	S_2	333.9	275.7	265.6	351.0	409.3	347.1
	S_3	326.0	337.2	536.0	512.9	457.7	433.9
	mean	317.1	328.7	438.9	434.8	463.7	396.6
G. mean		247.0	268.9	352.9	356.9	377.5	
Mean of Salinity (S)							
	S_0	169.1	197.7	340.2	314.0	442.1	312.6
	S_1	267.2	235.1	276.3	354.9	289.9	284.7
	S_2	300.0	269.4	341.4	343.6	396.4	330.1
	S_3	251.9	273.3	253.8	415.4	381.6	355.2

LSD 0.05: M: 2.4 ; S: 3.4 ; N: 3.8 ; MS: 4.8 ; MN: 5.3 ; SN: 7.5 ; MSN:10.7

Na uptake in grains:

The lowest Na uptake in grains was 11.42 g pot^{-1} caused by $M_0S_2N_0$. The highest Na uptake 30.44 g pot^{-1} was by $M_1S_2N_2$ with an increase of 166.5%. (Table 7). The main effect of magnetization shows a pattern of $M_1>M_0$ with an increase of 13.1% due to M_1 under Conditions of N4 there was no difference between M0 and M1 Under conditions of S2 the pattern was M0>M1 The main effect of salinity shows $S_2>S_0>S_3>S_1$ with an increase of about 18.0% due to S_2 and decreases averaging 5.4, 1.8% due to S_1, S_3 respectively under no magnetization the pattern agres with the main effect, but under magnetization it was $S_1>S_2>S_3>S_0$. Under N4 it was S2>S0>S>S3.

The N fertilization main effect shows a pattern of $N_4>N_2>N_3>N_1>N_0$ with increase averaging 7.0, 129.3, 35.3 and 39.0% due to N_1, N_2, N_3 and N_4 respectively.. Under conditions of no magnetization the pattern was $N_4>N_3>N_2>N_1>N_0$. Under conditions of magnetization it was $N_3>N_4>N_2>N_0>N_1$. Under conditions S1 the pattern was N4>N0>N3>N2>N1.

Table 7: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on Na uptake in grainsm g pot^{-1}.

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)					mean
		N_0	N_1	N_2	N_3	N_4	
Non Magnetized	S_0	14.37	15.41	14.37	17.55	28.55	18.05
	S_1	11.72	12.37	18.16	15.57	18.44	15.25
	S_2	11.42	20.63	30.44	30.38	29.62	24.50
	S_3	12.86	19.26	20.40	20.63	14.97	17.62
	mean	12.60	16.92	20.84	21.03	22.90	18.85
Magnetized	S_0	13.97	22.25	24.40	21.96	22.80	21.07
	S_1	27.66	19.01	18.32	21.92	21.86	21.75
	S_2	20.67	15.98	22.17	24.95	24.55	21.66
	S_3	18.95	15.81	21.92	25.12	22.21	20.80
	mean	20.31	18.26	21.70	23.50	22.85	21.32
G. mean		16.45	17.60	21.27	22.26	22.87	
Mean of Salinity (S)							
	S_0	14.17	18.83	19.38	19.75	25.67	19.56
	S_1	19.70	15.70	18.24	18.74	20.15	18.50
	S_2	16.05	18.31	26.30	27.66	27.08	23.08
	S_3	15.90	17.54	21.15	22.88	18.60	19.21

LSD 0.05: M: 0.2 ; S: 0.27 ; N: 0.3 ; MS: 0.4 ; MN: 0.43 ; SN: 0.6 ; MSN: 0.87

Nitrogen recovery by straw (NR): N recovery by straw ranged from 0.11 to 7.76 g pot^{-1} due to $M_0S_0N_3$ and $M_1S_2N_1$, respectively. (Table 8). The main effect of magnetized gave an increase due to M_1. The main effect of salinity show an increase in nitrogen recovery when the salinity was in medium rates. The main effect of N fertilization gave an increase in NR due to N_1 followed by N_2.

N recovery (NR) by grains ranged from 0.65 to 25.14 g pot^{-1} due to $M_0S_0N_1$ and $M_1S_1N_1$, respectively (Table 9). The main effect of magnetized gave an increase due to M_1. The main effect of salinity show an increase in NR when the salinity was high. The main effect of N fertilization gave an increase in NR due to N_2 followed by N_1.: Harmsen and Garabet (2003) refers to the recovery by subtraction as the "apparent N-recovery fraction whereas that given by the ^{15}N tracer as the "^{15}N recovery fraction.

Nitrogen which remained in soil after harvest (NrS):

^{15}N which remained in the soil is shown in Table 10. The values ranged from 0.13 to 0.65 due to $M_0S_2N_1$ and $M_1S_3N_1$, respectively. The main effect of magnetization shows an increase due to M_1. Under conditions of magnetization and N_4 there was high g kg^{-1} soil of N remaining in the soil after harvest. The main effect of salinity gave a pattern of $S_0>S_1>S_2>S_3$. N fertilization main effect gave high ^{15}N in the soil under conditions of N_4.

Table 8: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on N recovery by straw (%).

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)				Mean
		N_1	N_2	N_3	N_4	
Non Magnetized	S_0	0.26	0.15	0.11	0.60	0.28
	S_1	2.12	0.98	0.72	0.65	1.12
	S_2	3.46	3.65	0.29	0.34	1.93
	S_3	1.69	0.43	0.46	0.04	0.66
	mean	1.88	1.30	0.39	0.41	1.00
Magnetized	S_0	2.42	0.09	1.70	4.93	2.28
	S_1	6.04	6.53	2.49	3.04	4.52
	S_2	7.76	2.28	0.30	0.17	3.13
	S_3	5.92	4.47	0.26	1.55	3.05
	mean	5.53	3.84	1.19	2.42	3.25
G. mean		3.71	2.57	0.79	1.41	2.12
	S_0	1.34	0.12	0.90	2.76	1.28
	S_1	4.08	3.75	1.60	1.85	2.82
	S_2	5.61	3.97	0.30	0.25	2.53
	S_3	3.81	2.45	0.36	0.80	1.85

Table 9: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on N recovery in grains (%).

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)				Mean
		N_1	N_2	N_3	N_4	
Non Magnetized	S_0	0.65	9.15	4.57	8.91	5.80
	S_1	6.84	9.11	2.62	2.89	5.37
	S_2	20.23	20.72	18.19	14.52	18.41
	S_3	24.11	16.88	14.72	2.34	14.51
	mean	12.93	13.97	10.03	7.16	11.02
Magnetized	S_0	14.36	26.12	8.51	6.23	13.81
	S_1	25.14	9.18	16.53	3.33	13.54
	S_2	17.28	10.60	5.82	4.05	9.44
	S_3	8.45	39.39	15.84	8.82	18.13
	mean	16.31	21.32	11.68	5.61	13.73
G. mean		14.62	17.64	10.85	6.38	12.38
	S_0	7.46	17.64	6.54	7.57	9.80
	S_1	15.99	9.15	9.57	3.11	9.46
	S_2	18.45	15.66	12.01	9.28	13.93
	S_3	16.28	28.13	15.28	5.58	16.32

Table 10: Effect of nitrogen fertilizer rate and irrigated with magnetized and non-magnetized saline water on N remained in soil harvest (g kg^{-1}).

Magnetized (M)	Salinity (S)	Nitrogen fertilization (N)				Mean
		N_1	N_2	N_3	N_4	
Non Magnetized	S_0	0.17	0.23	0.66	0.15	0.30
	S_1	0.28	0.20	0.15	0.28	0.23
	S_2	0.13	0.18	0.62	0.82	0.44
	S_3	0.62	0.10	0.12	0.25	0.27
	mean	0.30	0.18	0.39	0.38	0.31
Magnetized	S_0	0.46	0.30	0.55	0.51	0.46
	S_1	0.38	0.14	0.23	1.12	0.47
	S_2	0.30	0.18	0.18	0.28	0.24
	S_3	0.65	0.14	0.15	0.26	0.30
	mean	0.45	0.19	0.28	0.54	0.36
G. mean		0.37	0.18	0.33	0.46	0.34
	S_0	0.31	0.27	0.61	0.33	0.38
	S_1	0.33	0.17	0.19	0.70	0.35
	S_2	0.22	0.18	0.40	0.55	0.34
	S_3	0.63	0.12	0.13	0.25	0.29

REFERENCES

Abd El-Hady, B.A. (2007). Effect of zinc application on growth and nutrient uptake of barley plant irrigated with saline water. J. Appl. Sci. Res. 3 (6): 431–436.

Al-Khazan, M., M. Batoul and N. Al-Assaf (2011). Effects of magnetized low quality water on some soil properties and plant status: chlorophyll pigments and some elements content of Jojoba (Simmondsia chinensis L.) at different growth stages. Afr. J. Environ. Sci. Technol. 5: 722–731.

Ayman, M.H.A. (2015). Assessment of water quality of wastewaters of Bahr El-Baqar, Bilbies and El-Qalyubia drains in east delta, Egypt for irrigation purposes. Egypt J. Soil Sci. Egypt J. Soil Sci. 55: 119-146.

Chang, K.T. and C.I. Weng (2006). The effect of an external magnetic field on the structure of liquid water using molecular dynamics simulation. J. App. Phys. 100: 43917–43922.

Colic, M. and D. Morse (1999). The elusive mechanism of the magnetic 'memory' of water. Coll. Surf. 154 (1–2), 167–174.

Estefan, G., R. Sommer and J. Ryan (2013). Methods of soil, plant and water analysis: a manual for the West Asia and North Africa region. Intl. Center Agric. Res. Dry Areas (ICARDA), 3rd edition.

FAO, (2009). Agribusiness Handbook: Barley, Malt, Beer. FAO Investment Centre Division (accessed on 11.12.15.). Available at:http://www.fao.org/fileadmin/user_u

pload/tci/docs/AH3_BarleyMaltBeer.pdf.

Gupta, M., N. Abu-Ghannam and E. Gallagher (2010). Barley for brewing: characteristic changes during malting, brewing and applications of its by-products. Compr. Rev. Food Sci. Food Saf. 9: 318-328.

Harmsen, K. and S. Garabet (2003). A comparison of the isotope-dilution and the difference method for estimating fertilizer nitrogen recovery fractions in crops. III. Experimental. Nuclear J. Appl. Sci. 51: 237-261.

Hozayn, M. and A.M.S. Abdul Qados (2010). Irrigation with magnetized water enhances growth, chemical constituent and yield of chickpea (Cicer arietinum L.). Agric. Biol. J. North Am. 1: 671–676.

Hozayn, M., M.M. Canola Abdallha, A.A. Abd El-Monem, A.A. El-Saady and M.A. Darwish (2016). Applications of magnetic technology in agriculture: a novel tool for improving crop productivity. Afr. J. Agric. Res. 11 (5): 441–449.

IAEA (2001). Training course. International Atomic Energy Agency (IAEA) No. 14, Vienna, Austria.

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: 1229–1236.

Matwijczuk, A., K. Kornarzynski and S. Pietruszewski (2012). Effect of magnetic field on seed germination and seedling growth of sunflower. Int. Agrophys. 26: 271–278.

Parida, A. K. and A. B. Das (2005). Salt tolerance and salinity effects on plants. Ecotox. Envirion. Saf. 60: 324-349.

Quan, X., Q. Qian, Z. Ye, J. Zeng, Z. Han and G. Zhang (2016). Metabolic analysis of two contrasting wild barley genotypes grown hydroponically reveals adaptive strategies in response to low nitrogen stress. Journal of plant physiology 206: 59-67.

Selim, El-Nady (2011). Physio-anatomical responses of drought stressed tomato plants to magnetic field. Acta Astron. 69: 387–396.

Soltanpour, P. N. (1985). Use of ammonium bicarbonate DTPA soil test to evaluate elemental availability and toxicity. Commun. Soil Sci. Plant Anal. 16:323-318.

Tanaka, M., P.T. Van, J.A. Teixeira da Silva and L.H. Ham (2010). Novel magnetic field system: application to micro propagation of horticultural plants. Biotech. Biotechnol. Equip. 24: 2160–2163.

Teixeira da Silva, J.A. and J. Dobránszki (2016). Magnetic fields: how is plant growth and development impacted? Protoplasma 253: 231–248.

Turker, M., C. Temirci, P. Battal and M.E. Erez (2007). The effects of an artificial and static magnetic field on plant growth chlorophyll and phytohormone levels in maize and sunflower plants. Phys. Ann. Rev. Bot. 46: 271–284.

Zaidi, N.M., Sohaili, Johan, Muda, Khalida, Sillanpaa and Mika (2014). Magnetic field application and its potential in water and wastewater treatment systems. Sep. Purif. Rev. 43: 206–240.

أثر معدلات السماد النتروجيني على انتاجية الشعير المروى بالمياه المالحة الممغنطة والغير ممغنطة مع تطبيق تقنية النظير المستقر النتروجين[١٥]

أحمد عبدالمنعم مرسى ، أنور حسين الخولى

هيئة الطاقة الذرية– مركز البحوث النووية – قسم بحوث الأراضي والمياه، أبو زعبل ١٣٧٥٩ ، مصر

الملخص العربى

اقيمت تجربة اصص فى الصوبة الزراعية وذلك بهدف دراسة تأثير مستويات مختلفة من الملوحة على محصول الشعير وكذلك دراسة تأثير المغنطة على انخفاض ملوحة الماء ودراسة امتصاص النتروجين ١٥ فى اجزاء النبات المختلفة.

اظهرت البيانات انخفاض محصول الحبوب ١١.٨٦ جرام/ بوط مع المعاملة(M0S3N0) والسبب يرجع الى تأثير ارتفاع الملوحة وقلة اضافة النتروجين وعلى العكس ادى اضافة نفس المعاملات مع التركيز المرتفع من النتروجين الى زياده في محصول الحبوب وكانت ٣٨.٨٠ جرام/بوط. وكانت المعاملة(M0S3N0) انخفاض فى محصول القش اعطت ١٠.٦٠ جرام/بوط بينما المعاملة(M0S3N4) ازداد محصول القش وكانت ٢٦.٤٠ جرام/بوط تاثر النتروجين الممتص بواسطة حبوب النبات فى نفس هذه المعاملات وكانت اعلاها فى المعاملة (M0S3N3) وكانت ٣٧٢.٩جرام /بوط النتروجين المستعاضة في الحبوب كان محتواه من ٠.٦٥ الى ٢٥.١٤ جرام/بوط على التوالي. (M0S0N1)و (M1S1N1) .

السادة المحكمين

أ.د/ على أحمد عبدالسلام كلية الزراعة – جامعة بنها

أ.د/ فاطمة سعد الشافعى كلية الزراعة – جامعة المنوفية