J.Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 8 (8): 383 - 389 , 2017

Effect of Magnetic Irrigation Water and Nitrogen Fertilizer Forms on Maize (*Zea maize L.*) Growth, Yield and Nitrogen Utilization Rate.

Kanany, R. E.; Kh. A. El-Naqma and M. M. Othman
Soils. Water and environment, Res. Ins. A. R.C.

ABSTRACT

A field experiment was conducted at the screen house of Agric. Res. Station, Sakha, Kafr El-Sheikh Governorate during the two successive summer seasons of 2015 and 2016 to investigate the effect of magnetic irrigation water and nitrogen fertilizer forms on maize growth, productivity and nitrogen utilization rate %. A split plot design was used. Zea maize seeds, third hybrid 324 were sown on June in both seasons. The recommended N fertilizer rate (120kg $N.fed^{-1}$). was applied in three fertilizer forms of 1- Urea 46%N or 2- Ammonium nitrate 33.5% N and or 3- ammonium sulphate 20.5% N under two irrigation water treatments of (normal water , and magnetized water). The other agricultural practices were performed . The obtained results can be summarized as follow: - No significant effects of magnetic water were observed on plant height, number of $leaves.plant^{-1}$ in first and second seasons but no significant on leaf area diameters in the first season only. Also no significant effects on chlorophyll A, ear diameter, ear length, biomass, available P in the soil after harvesting and nitrogen uptake in the first season. - Magnetic water significantly increased chlorophyll B, straw yield, available N in the soil after harvesting, P uptake and N uptake in the second season only .- Magnetic water (from nefertari Biomagneric company)significantly decreased grain yield of maize and N-utilization rate compared with the non-magnetic water.- Ammonium nitrate as N fertilizer form had the highest values of plant height, number of $leaves.plant^{-1}$, leaf area, ear length, grain yield, N uptake, P uptake, and N utilization rate. - Urea fertilizer as N form significantly increased chlorophyll A, B, total chlorophyll and decreased N utilization rate. - Ammonium sulphate with magnetic irrigation water had higher values for ear diameter, biomass, straw yield and available N, P in the soil after maize harvest compared with the magnetic water treatments. - The interaction between magnetic irrigation water and N-forms show that magnetic water decreased N utilization rate from ammonium sulphate and increased N utilization rate from ammonium nitrate.

Keywords: Magnetic water, nitrogen forms, maize growth and utilization rate.

INTRODUCTION

Maize is one of the most important cereal crops. It has a third position of the cereal crops in Egypt after wheat and rice. Maize is use in human food and their livestock feed. Egypt is suffering from irrigation water shortage and the policy of the governorate is to use other sources beside Nile river. Magnetic technology is used for saline or brackish water management. The water treated by magnetic field or pass-through a magnetized device called magnetized water, when water is magnetized, some physical and chemical properties changed that may be causing changes in plant growth and production Abedinpour and Rohani (2017).There are some changes occurred in the physical and chemical properties of water according to magnetic water, mainly hydrogen bonding, polarity, surface tension, conductivity, pH and solubility of salts, and these changes in water properties may be capable of affecting the growth of plants Grewal and Maheshwari (2011).

Some researchers concluded that magnetic water enhanced the plant growth (Turker *et al.*, 2007 and Abou El-Yazied *et al*., 2012). A significant increases of plant height (cm) , number of $branches.plant^{-1}$, number of $leaves.plant^{-1}$, leaf area (cm^2) , root length (cm) , number of $pods.plant^{-1}$ of peas, number of $seeds.pod^{-1}$ and pod length (cm) as a result of irrigation with magnetized water compared with these parameters values resulted from irrigation using non-magnetized water Midan and Tantawy (2013).

Osman *et al*.,(2014) showed that the irrigation with magnetic water increased significantly plant height, No. of leaves / plant as well as fresh and dry weight, root fresh weight of pea plants in both seasons.. In most cases, the growth parameters (shoot and root) of pea seedlings were improved significantly by using magnetic technology with lowest salinity of irrigation water 1000 ppm (fresh water) while, the opposite trend was recorded by raising salinity up to 4000 and 5000 ppm without magnetic technology in both seasons.

Magnetic treatment of irrigation water led to a significant increase of snow pea and chickpea contents of N, K, Ca, Mg, S, Na, Zn, Fe and Mn compared to control . The results suggested that both magnetic treatment of irrigation water and seeds have the potential to improve nutrient contents of seedlings (Grewal and Maheshwari ,2011; Abdelaziz *et al ., 2014,* El Sayed 2015 , Ahmed and Bassem 2013 and Ahmed and Abd El-Kader 2016).

Rechcigl and Colon (2000) studied the sources of Nitrogen i.e ammonium nitrate and ammonium sulphate on bahigrass production and quality and they showed that the highest yields were obtained with ammonium-sulphate as compared to ammonium nitrate.

The objective of the present study is to investigate the effects of magnetic water and N-fertilizer forms on maize vegetative growth and yield as well as nitrogen utilization rate.

MATERIALS AND METHODS

A field experiments was conducted at the screen house of Agricultural Research Station, Sakha, Kafr El-Sheikh Governorate during the two successive summer seasons of 2015 and 2016 to investigate the effect of magnetic water and N-fertilizer forms on maize vegetative growth and yield as well as nitrogen fertilizer forms utilization rate. Maize seeds (*Zea maize*) var. third hybrid 324 were sown on 17^{th} and 22 June in the first and second season, respectively. The soil was prepared, 7 $kg.fed^{-1}$. of grains were sown. A split plot design was used with four replicates. The main plots were assigned to two irrigation water treatments 1- Magnetic water and 2- Non-magnetic water. The sub plots were assigned with four treatments 1- without N-fertilizer, 2- Urea as N form 3, - ammonium nitrate (33.5%N) and 4-ammonium sulphate (20.5%N) as nitrogen, the recommended dose (120 kg N fed^{-1}) from each form was applied in three doses, the first dose was 20 kg $N.fed^{-1}$ with the sowing irrigation, the second dose 50 kg $N.fed^{-1}$ with the second irrigation and the third dose 50 kg N fed^{-1} with the third irrigation. superphosphate 15.5 Kg $P_2O_5.fed^{-1}$ was applied in one dose with the soil preparation. Potassium was applied as potassium sulphate (48% K_2O) at the level 24 kg K_2O fed^{-1} in one dose with the second irrigation. The other agricultural practices were applied as recommended in the region. The magnetic water is the normal water (Nile water) that has been exposed to magnetic field by passing through, a magnetic device (Fig 1) supplied by Nefertari Biomagnetic Company and installed on the main irrigation line before the application to the plants. The device comprised of two magnets (40 Mega Tesla), arranged to the north and south poles. The directions of magnetic field generated at the flow rate diameters 2 inch.

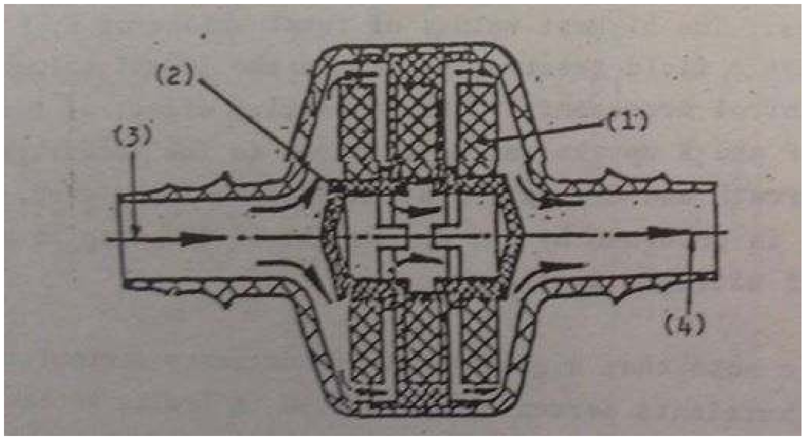

Figure 1: The magnetic device used in experiments.
1)Body 2) ring 3) inlet 4)outlet

Plant samples were taken at silking stage (70 days from sowing) and were taken also with harvesting to determine the vegetative growth, yield and some nutrients statues. Soil samples were taken after harvesting and air dried, crushed, some physical and chemical properties were determined according to Jackson (1967) and Black et al. (1965) Some soil chemical and physical properties (Table 1).

Table 1. Some chemical and physical properties of the experimental soil (0-60 cm).

seasons	Partical size distribert			texture	pH 1:2.5	EC Soil paste Ex. $Ds.m^{-1}$	Cation soluble.meq.L^{-1}				Anion soluble meq. L^{-1}			
	Sand%	Silt%	Clay%				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Co_3^{--}	Hco_3^{-}	cl^{-}	So_4^{--}
1st	10	39	51	clayey	7.9	2.3	8	6.4	8.2	0.6	-	2.2	10	11
2nd	10	37	53	clayey	8.0	2.5	8.4	6.4	8.4	1.9	-	3.1	11	11

Available nitrogen of the soil was extracted by 1N potassium chloride and determined by Kjeldahl method (Jackson, 1967), phosphorus was extracted by 0.5N Sodium bicarbonate and colormitrically measured by spectrophotometer (Jackson, 1967). Chlorophyll A and B were determined by N, N-Dimethyl formamide according to (Mora , 1982).

Plant samples oven dried at 70^0C and ground thoroughly, wet digested using sulphuric and perchloric acids mixture, total nitrogen and total phosphorus were determined according to Jackson (1967). N utilization rate was calculated according to the following equation
N utili. = N uptake for treatment - N uptake for control / N applied for treatment Finck (1982).

The obtained results were statistically analyzed according to Gomez and Gomez (1984), using Costat computer program, less significant deviosion according to Duncan (1955).

RESULTS AND DISCUSSION

Data presented in Table 2 show that there is no significant effects of magnetic water on plant height, number of $leaves.plant^{-1}$ and leaf area of maize were detected in both seasons. On the other hand Table data 2 show significant differences between the nitrogen fertilizer forms on plant height, number of leaves/plant and leaf area of maize at the silking stage, where the control treatment gave the lowest values. Ammonium nitrate treatment gave the highest values for the stated parameters. The values of the plant height ; No. of leaves/plant and leaf area at the silking stage had the descending order of ammonium nitrate > urea > ammonium sulphate > control. This may be due to the different effects of magnetic field on different nitrogen forms. These results could be supported with those obtained by Zhaopengou Yang *et al.,* 2013 and El-Kholy *et al.,* 2015.

Data in Table 3 indicate that, the interaction effect between magnetic irrigation water and nitrogen fertilizer forms on number of leaves.plant^{-1} was significant while in the second season control treatment under magnetic water recorded the lowest value application of ammonium nitrate under magnetic water gave the highest average value of No. of leaves per plant (14.5). In respect to effect of the interaction on leaf area (Table 3) the highest values (769.5 and 846.4 cm) were obtained with magnetic water and ammonium sulfate in the first and second seasons respectively.

Table 2. Effect of magnetic irrigation water and nitrogen fertilizer forms on maize growth parameters at silking stage during 2015 and 2016 growth seasons.

Treatments	Plant height cm		No. of leaves.plant^{-1}		Leaf area (cm^2)	
	1 st	2 nd	1 st	2 nd	1 st	2 nd
A- Irrigation water						
Magnetic water	143.88	148.69	11.06	12.75	650.93	716.03
Non Magnetic water	151.28	156.00	11.25	13.43	687.87	756.66
L.S.D at 0.05 for main plots	14.26	11.52	1.04	0.88	111.00	122.10
F.T.	Ns	Ns	Ns	Ns	Ns	Ns
B- Nitrogen forms						
Control	95.75	100.75	9.87	11.50	545.13	599.64
urea	162.69	167.12	11.37	13.625	707.5	727.03
Ammonium Nitrate	182	187	12.25	14.375	691.86	761.05
Ammonium Sulphate	149.89	154.5	11.125	12.875	733.14	806.45
L.S.D at 0.05 for sub main	15.46	15.74	0.92	1.15	76.59	84.25
F.T.	*	*	*	*	*	*

Table 3. Effect of interaction between magnetic irrigation water and nitrogen fertilizer forms on maize growth parameters at silking stage during both seasons.

Treatments		Plant height (cm)		No. of leaves.plant^{-1}		Leaf area (cm^2)	
		1 st	2 nd	1 st	2 nd	1 st	2 nd
Magnetic water	Control	90.125	95.25	9.75	10.50	410.50	451.55
	Urea	164.38	169	11.5	13.5	731.50	702.21
	Ammonium Nitrate	174.00	179.25	12.25	14.5	962.22	761.44
	Ammonium Sulphate	147.03	151.25	10.75	12.50	769.53	846.48
Non-Magnetic water	Control	101.37	106.25	10.00	12.5	679.75	747.73
	Urea	161.00	165.25	11.25	13.75	683.50	751.85
	Ammonium Nitrate	190.00	194.75	12.25	14.25	691.5	760.65
	Ammonium Sulphate	152.75	157.75	11.5	13.25	696.75	766.42
L.S.D at 0.05 for sub main		21.86	22.72	1.31	1.62	108.32	119.15
F.T.		Ns	Ns	Ns	*	*	*

It is clear from the data of Table 4 that insignificant increases in the values of chlorophyll A and total chlorophyll were detected due to irrigate with magnetic water in both seasons. While, chlorophyll B were increased significantly due to treatment with magnetic water. This may due to magnetic water differ in some characters i.e., viscosity, charges, density etc., which affected plant growth and physiology. These results could be enhanced with those obtained by Grewal and Maheshwari (2011) and Dandan and Shi (2013) who concluded that the physical and chemical properties of magnetized water have a series of changes which lead to special functions .

Table 4. Effect of magnetic irrigation water and nitrogen fertilizer forms on chlorophyll pigments at silking stage.

Treatments	Chlo. A mg.cm^{-1}		Chlo. B mg.cm^{-1}		Total Chlo. mg.cm^{-1}	
	1 st	2 nd	1 st	2 nd	1 st	2 nd
A- Irrigation water						
Magnetic water	7.03	7.74	6.59	6.97	13.38	14.72
Non Magnetic water	6.36	6.99	4.97	5.46	11.56	12.46
L.S.D at 0.05 for main	1.53	1.68	1.17	1.30	2.30	2.96
F.T.	Ns	Ns	*	*	Ns	Ns
B- Nitrogen forms						
Control	3.39	3.73	2.87	3.16	6.27	6.89
Urea	8.39	9.23	7.12	7.83	15.51	17.06
Ammonium Nitrate	7.74	8.51	6.29	6.92	14.04	15.44
Ammonium Sulphat	7.27	8.00	6.30	6.96	13.60	14.96
L.S.D at 0.05 for submain	0.31	0.34	0.84	0.95	0.71	0.78
F.T.	*	*	*	*	*	*

It is clear from data of Table 5 that the interaction effects between magnetic irrigation water and nitrogen fertilizer forms on chlorophyll A and total chlorophyll were significant. Where the lowest averages values was recorded with control treatment under non-magnetic water, while the highest average values was achieved with ammonium nitrate application under magnetic water. It is observed that ammonium sulphate application gave better results under non-magnetic water compared to magnetic water. On the contrary of that urea application gave highest values under magnetic water than non-magnetic water.

Data also reveal that; both of chlorophyll A, B and total chlorophyll were highly significantly increased due to urea application as nitrogen fertilizer form. Data also show that control treatment gave the lowest values. While ammonium nitrate treatment gave higher values af chlorophyll A and total chlorophyll with ammonium sulphate. This may be due to that ammonium nitrogen had two forms of ions, cation (NH4) and anoin (NO_3) which increased N absorption in addition to presence of No3 that enhance Mg and Fe absorption, which affect positively chlorophyll content. These results are in harmony with the findings of Mengel and Kirkby (1978) .

Table 5. Effect of the interaction between magnetic irrigation water and nitrogen fertilizer forms on chlorophyll pigments at silking stage.

Treatments		Chlo. A ($mg.cm^{-1}$)		Chlo. B ($mg.cm^{-1}$)		Total Chlo. ($mg.cm^{-1}$)	
		1 st	2 nd	1 st	2 nd	1 st	2 nd
Magnetic water	Control	3.55	3.90	3.11	3.42	6.66	7.32
	Urea	8.51	9.37	7.92	8.72	16.44	18.08
	Ammonium Nitrate	9.06	9.97	7.83	8.61	16.90	18.59
	Ammonium Sulphate	7.03	7.73	6.48	7.31	13.51	14.86
Non-Magnetic water	Control	3.24	3.56	2.63	2.89	5.87	6.45
	Urea	8.27	9.09	6.31	6.95	14.58	16.04
	Ammonium Nitrate	6.42	7.06	4.76	5.24	11.18	12.30
	Ammonium Sulphate	7.53	8.28	6.16	6.77	13.68	15.06
L.S.D at 0.05 for sub main		0.44	0.48	1.44	1.34	1.00	1.10
F.T.		*	*	Ns	Ns	*	*

Generally, data in Table 6 show the values of ear diameter, ear length, biomass, grain yield and straw yield in 2015 and 2016 seasons as affected by magnetic irrigation water and nitrogen fertilizer forms. The data indicated that magnetic water had no significant effect of ear diameter, ear length and biomass. But grain yield decreased significantly due to used magnetic water. While, straw yield was increased significantly due to using of magnetic water. This may be due to that maize root growth affected negatively by magnetic water. Similar results were reported by Turker *et al.,* (2007) who reported that on inhibitory effect of staric magnetic field on root dry weight of maize plants. Also, data in Table 6 show that the difference between nitrogen fertilizer forms effects on maize yield and its components were significant. The control treatment had the lowest means of maize yield and it's components. While, ammonium nitrate gave the highest average of ear length and grain yield parameters. On the other hand, the highest average of ear diameter, biomass and straw yield were obtained with treatment with ammonium sulphate. This may be due to the different effects of magnetic water on the absorption of different forms of anion, cation and molecular. Similar results were reported by Zhaopeng ou Yang *et al.,* (2013).

Table 6. Effect of magnetic irrigation water and nitrogen fertilizer forms on maize yield and it's component.

Treatments	Ear diameter (cm)		Ear length (cm)		Biomass $ton.fed^{-1}$		Grain yield $ardb.fed^{-1}$		Straw yield $ton.fed^{-1}$	
	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
A- Irrigation water.										
Magnetic water	5.49	6.03	29.04	31.95	30.32	33.35	24.43	26.87	9.51	10.46
Non Magnetic water	5.50	6.05	28.53	31.39	30.11	33.12	27.53	30.28	8.95	9.84
F.T.	Ns	Ns	Ns	Ns	Ns	Ns	*	*	*	*
B- Nitrogen forms.										
Control	4.74	5.22	24.35	26.79	20.77	22.85	11.47	12.62	7.09	7.80
Urea	5.64	6.21	30.30	33.33	32.02	35.23	28.02	30.83	9.52	10.47
Ammonium Nitrate	5.72	6.30	30.50	33.55	31.34	34.47	33.70	37.07	9.05	9.56
Ammonium Sulphate	5.89	6.48	30.03	33.03	36.72	40.40	30.74	33.82	11.26	12.39
L.S.D at 0.05 for sub main	0.23	0.25	1.65	1.82	0.84	0.93	1.02	1.12	0.55	0.61
F.T.	*	*	*	*	*	*	*	*	*	*

- **Ardb= 140Kg**

Data in Table 7 indicate that the interaction effect between magnetic irrigation water and nitrogen fertilizer forms on maize yield and its components was significant where the lowest average values were recorded with control treatment under non-magnetic water while the highest averages values were with ammonium sulphate application which gave better results of biomass, grain and straw yield, But ammonium nitrate gave better results of grain and straw yield under magnetic water than non-magnetic water.

Table 7. Effect of interaction between magnetic irrigation water and nitrogen fertilizer forms on maize yield and it's components.

		Ear diameter cm 2		Ear length cm2		Biomass		Grain yield ardb.fed-1		Straw yield ton.fed-1	
		1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
Magnetic water	Control	4.90	5.39	25.47	28.08	23.29	25.62	9.92	10.91	8.25	9.07
	Urea	5.69	6.26	30.45	33.49	35.60	39.16	26.83	29.51	11.12	12.23
	Ammonium Nitrate	5.74	6.32	30.49	33.54	27.18	29.89	36.42	40.06	7.37	8.11
	Ammonium Sulphat	5.63	6.19	29.93	32.91	35.22	38.74	24.55	27.01	11.30	12.43
Non Magnetic water	Control	4.57	5.03	23.24	25.56	18.26	20.08	13.02	14.32	5.93	6.52
	Urea	5.60	6.16	30.14	33.16	28.45	31.29	29.22	32.14	7.91	8.71
	Ammonium Nitrate	5.70	6.27	30.50	33.55	35.49	39.04	30.97	34.07	10.73	11.81
	Ammonium Sulphate	6.15	6.76	30.27	33.29	38.23	42.05	36.92	40.61	11.22	12.34
L.S.D at 0.05 for sub main		0.33	0.36	2.34	2.34	1.20	1.32	1.44	1.59	0.78	0.86
F.T.		*	*	*	*	*	*	*	*	*	*

The data obtained from Table 8 show that no significant effect of magnetic water on available P in both seasons, and there is no significant effect on N uptake on 1st season only, But there were significant effect on available N and P uptake in both seasons, and N uptake in the 2nd seasons. On the other hand Table 8 show that differences between the effect of nitrogen fertilizer forms on available N , available P, N uptake and P uptake were high significant, where the control treatment had the lowest values while ammonium sulphate gave the highest values of available N, P. On the other hand, the highest values of N uptake and P uptake were recorded with ammonium nitrate. This may be due to ammonium sulphate application have residual low pH in the soil which have positive effect of P availability in the soil. Ammonium nitrate had the highest N uptake due to presence of NH^{+}_{4} as cation and NO^{-}_{3} as anion which enhanced N uptake **(Tisdal et al1990).** Also the magnetic field affected cation (+ charge) rather than anions (- charge).

Table 8. Effect of magnetic irrigation water and nitrogen fertilizer forms on available N&P in the soil and its uptake by plant.

Treatments	Available N		Available P		N uptake Kgfed-1		P uptake Kgfed-1	
	1 st	2 nd	1 st	2 nd	1 st	2 nd	1 st	2 nd
A-Irrigation water								
Magnetic water	22.84	25.13	16.49	18.14	45.88	53.60	10.59	10.75
Non Magnetic water	21.33	23.47	16.32	17.95	47.85	57.63	8.88	9.59
F.T.	*	*	Ns	Ns	Ns	*	*	*
B-Nitrogen forms								
Control	17.58	19.36	11,20	12.32	17.53	21.07	3.67	3.68
Urea	23.73	26.10	18.66	20.53	49.01	57.84	11.11	11.14
Ammonium Nitrate	21.3	23.43	15.24	16.76	65.52	80.39	12.81	13.97
Ammonium Sulphate	25.77	28.33	20.54	22.60	55.42	63.16	11.36	11.89
L.S.D at 0.05 for sub main	0.97	1.07	0.35	0.40	2.97	2.24	0.99	0.52
F.T.	*	*	*	*	*	*	*	*

Table 9 represents the effect of interaction between magnetic irrigation water and nitrogen fertilizer forms on available N&P in the soil after the harvesting and its uptake by plant. Significantly effects of all parameters (available N and available P) in the soil and N , P uptake by plant were detected . where the lowest values were recorded due to control treatments under non-magnetic water, while treatment with ammonuim sulphate gave better results under non-magnetic water in available N (26.17 and 28.79 mg kg^{-1}) in the first and second season, respectively. The highest values of available P (22.42 and 24.67 mg kg^{-1}) were obtained with ammonium sulphate under magnetic irrigation water. This may be due to decrease of pH value, resulted from magnetic water and residual of ammonium sulphate. Ammonium nitrate under magnetic water had the highest N uptake (74.78 and 92.76 kg N fed^{-1}) in the first and second season, respectively and P uptake (14.77 and 16.28) mg kg^{-1} in the first and second season, respectively.

Generally data in Table 10 recorde the values of N utilization rate, data show that there is significant effect of magnetic water and nitrogen forms on utilization rate % in both seasons. Non-magnetic water gave the highest values of N on utilization rate % compared with magnetic water. On the other hand, Ammonium nitrate gave the highest values of N utilization rate in both seasons , respectively.

Table 9. Effect of the interaction between magnetic irrigation water and nitrogen fertilizer forms on available N&P mgkg^{-1} in the soil after harvesting and its uptake by plant.

Treatments		Available N mgkg^{-1} 1 st	2 nd	Available P mgkg^{-1} 1 st	2 nd	N uptake Kgfed.$^{-1}$ 1 st	2 nd	P uptake Kgfed.$^{-1}$ 1 st	2 nd
Magnetic water	Control	20.45	22.49	11.20	12.32	14.41	16.56	4.11	4.00
	Urea	24.35	26.75	18.66	20.52	50.08	56.73	14.01	13.02
	Ammonium Nitrate	21.25	23.37	13.70	15.07	74.78	92.76	14.77	16.28
	Ammonium Sulphate	25.34	27.87	22.42	24.67	44.26	48.36	9.51	9.71
Non Magnetic water	Control	14.70	16.17	11.20	12.32	20.65	25.57	3.22	3.38
	Urea	23.11	25.42	18.66	20.53	47.93	58.96	8.21	9.26
	Ammonium Nitrate	21.35	23.48	16.77	18.45	56.25	68.03	10.85	11.66
	Ammonium Sulphate	26.17	28.79	18.66	20.66	66.57	77.97	13.22	14.07
L.S.D at 0.05 for sub main		1.38	1.52	0.50	0.55	4.20	3.17	1.41	0.74
F.T.		*	*	*	*	*	*	*	*

Table 10. Effect of magnetic irrigation water and nitrogen fertilizer forms on N utilization rate .

Treatments	N-utilization rate % (grain) 1 st	2 nd	N-utilization rate % (straw) 1 st	2 nd	Total N-utilization 1 st	2 nd
A- Irrigation water						
Magnetic water	28.50	31.35	11.095	12.20	39.60	43.55
Non Magnetic water	32.12	35.33	10.44	11.48	42.56	46.81
L.S.D at 0.05 for main	1.225	1.925	0.43	0.48		
F.T	*	*	*	*		
B-Nitrogen forms						
Urea	32.69	35.97	11.11	12.215	43.8	48.19
Ammonium Nitrate	39.32	43.25	10.56	11.15	49.88	54.4
Ammonium Sulphate	35.86	39.46	13.14	14.46	53.92	53.92
L.S.D at 0.05 for sub main	1.19	1.31	0.64	0.71		
	*	*	*	*		

Data of Table 11 present the effects of interaction between magnetic irrigation water and nitrogen forms on N-utilization rate values. Data show that a significant effect was detected, the lowest values were obtained with ammonium sulfate application under magnetic water while the same treatment (ammonium sulphate) under non-magnetic water gave the highest values .

Table 11. Effect of interaction between magnetic irrigation water and nitrogen fertilizer forms on nitrogen utilization rate.

Treatments		N-Utilization rate % (grain) 1st	2nd	N-utilization rate % (straw) 1st	2nd	Total N-utilization 1st	2nd
Magnetic water	Urea	31.30	34.43	12.97	14.27	44.27	48.7
	Ammonium nitrate	42.49	46.74	8.60	9.46	51.09	56.2
	Ammonium sulphate	28.64	31.51	13.18	14.50	41.82	46.01
Non magnetic water	Urea	34.09	37.50	9.23	10.16	43.32	47.66
	Ammonium nitrate	36.13	39.74	12.52	13.78	48.65	53.52
	Ammonium sulphate	43.07	47.38	13.09	14.40	56.16	61.78
L.S.D at 0.05 for Sub main		1.68	1.855	0.91	1.00		
F.T		*	*	*	*		

REFERENCES

Abdelaziz, A. M., Elshokali and A., Abdelbagi, M. (2014). Impact of magnetized water on elements contents in plants seeds. Int. J. of Sci. Res. and Innovative Technology . 1(4): 12-21.

Abou El-Yazied, A., El-Gizawy, A.M., Khalf,S. M., El-Satar, A. and Shalaby , O.A. (2012) . Effect of magnetic field treatments for seeds and irrigation water as well as N, P and K levels on productivity of tomato Plants. J. of Applied Sci. Res. 8(4): 2088-2099.

Ahmed, I. M. and Bassem, M. E. (2013). Effect of irrigation with magnetically treated water on faba bean growth and composition International J. of Agric. Policy and Res. 1 (2): 024-040.

Ahmed, M. E. M. and Abd El-Kader, N. I. (2016). The Influence of magnetic water and water regimes on soil salinity, growth, yield and tubers quality of potato plants.Middle East J. of Agric. 5(2):132-143.

Abedinpour, M. and Rohani, E. (2017). Effect of magnetized water application on soil and maize growth indices under different amount of salts in the water. J. of water reuse and desalination . 7(3) 319-325.

Black, A. C., Evans, D. D., White , J. L., Ensminyer , E. L. and Clark , E. F. (1965). Methods of Soil Analyses. Soc. Agro. Ink. Madison Wiscosin USA.

Dandan, L. and Shi, Y. (2013). Effects of magnetized saline on growth and development of winter wheat seedlings. Adv. J. Food Sci. Technol. 5: 1596-1599.

Duncan, D. B. (1955). Mutiple Range and Multiple F-Test Biometrics. 11:1-42.

El-Kholy, M.F., Samia, S. H. and Farag, A. A. (2015). Effect of magnetic water and different levels of NPK on banana Plant Nature and Science;13(7):94-101.

Finck (1982)."Fertilizer and Fertilization". Weinheim beer field beach florida. Basel: verleg chemical. Pp:223.

Gomez, K. A. and Gomez, c. M. (1984). Statistical Procedure for Agriculture Research . John Wiley and Sons. Inc. New york.

Grewal, SH. and Maheshwari, B. L. (2011). Magnetic treatment of irrigation water and snow pea and chickpea seeds enhances early growth and nutrient contents of seedlings. Bioelectromagnetics. 32:(1):58–65.

Jackson, M. L. (1967). "Soil Chemical Analysis" Prentic-Hall,India, New Delhi, p: 183-203.

Mengel, K. and Kirkby, E. A. (1987). Principles of Plant Nutrition . International Potash Institue/ Switzerland.

Midanand, S. A. and Tantawy, M. F. (2013). Effect of magnetized irrigation water on mineral nitrogen fertilization efficiency, nutrients availability and pea plants productivity. Minufiya J. Agric. Res. 38: 423-443 .

Moran,R (1982). Formulae for determination of chlorophllous pigments extract with N, N-Dimethl formamide. J. of plant physiolo. 69.1376-1381.

Osman E.A. M., K.M Abd El-Latif, S.M. Hussien and A.E.A. Sherif (2014). Assessing the effect of irrigation with different levels of saline magnetic water on growth parameters and mineral contents of pea seedlings. Global J. of Sci.Res.2(5):128-136.

Rechcigl, J. E. and Colon, W. (2000). Influence of nitrogen sources and sulfur fertilizer on rahigross production and quality proceeding of the 35[ih] Annuai meeting of Caribbean food crops meeting Society. 25-31

Tisdale, S. L., Nelson, W. L., Beaton, J. D. (1990). "Soil Fertility and Fertilizers. Macmillan publishing company. New York.

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

Zhaopeng O. Y., Xurong M. F. G., Yuzhong L. and Jiaxuan G. (2013). Effect of different nitrogen fertilizer types and application measures on temporal and spatial variation of soil nitrate-nitrogen at cucumber. Field Journal of Environmental Protection, 4, 129-135.

تاثير الرى بالماء الممغنط وصور الاسمدة الازوتية على نمو ومحصول الذرة ومعدل الاستفادة من السماد النيتروجينى .

رمضان اسماعيل كنانى، خلود احمد النقمة و مها محمود عثمان
معهد بحوث الاراضى والمياه والبيئة ـ مركز البحوث الزراعية .

اجريت تجربتان بالصوبة السلكية بمحطة البحوث الزراعية بسخا -محافظة كفر الشيخ خلال الموسمين الصيفين ٢٠١٥-٢٠١٦ لدراسة تاثير الرى بالماء الممغنط من خلال المرور من جهاز ٤٠ ميجا تسلا من شركة نفرتيتى وصور السماد الازوتى على نمو وانتاجية الذرة الشامية ومعدل الاستفادة من السماد الازوتى من صور الاسمدة المختلفة و استخدم تصميم القطع المنشقة كما استخدم محصول الذرة هجين ثلاثى ٣٢٤ لتنفيذ المعاملات وتم زراعة المحصول فى يونيو خلال الموسمين . تم التسميد بالمعدل الموصى به من الاسمدة الازوتية ١٢٠ كجم ن / فدان من ثلاثة مصادر من الاسمدة : ١- اليوريا ٥و٤٦ % و ٢- نترات الامونيوم ٥و٣٣% و ٣- كبريتات النشادر ٥و٢٠% تحت معاملتين لمياه الرى ١- الرى بالماء العادى و ٢- الرى بالماء الممغنط وتم اجراء المعاملات الزراعية للذرة كما هو موصى به .ويمكن تلخيص النتائج المتحصل عليها فى الاتى --: لا يوجد تاثير معنوى للماء الممغنط على طول النبات وعدد الاوراق للنبات فى الموسم الاول والثانى ومساحة الورقة فى الموسم الاول فقط وكلوروفيل أ وقطر الكوز وطول الكوز والمحصول الحيوى والفسفور الميسر بالارض بعد الحصاد والنيتروجين الممتص فى الموسم الاول - . ادى الرى بالماء الممغنط الى زيادة معنوية فى المحتوى من كلوروفيل ب ومحصول القش والنيتروجين الميسر بالارض بعد حصاد الذرة والفسفور الممتص فى الموسمين والنتروجين الممتص فى الموسم الثانى . ـ قلل الرى بالماء الممغنط محصول الحبوب ومعدل الاستفادة من السماد . اعطت نترات الامونيوم كصورة للسماد الازوتى اعلى قيم لطول النبات وعدد الاوراق للنبات ومساحة الورقة وطول الكوز ومحصول الحبوب والنيتروجين الممتص والفسفور الممتص ومعدل الاستفادة من السماد الازوتى ـ ادت اليوريا كصورة للاسمدة الازوتية الى زيادة معنوية فى كلوروفيل أ و ب والكلورفيل الكلى وادت الى نقص معنوى فى معدل الاستفادة من السماد الازوتى للذرة ـ . اعطت سلفات الامونيوم مع الرى بماء عادى الى اعلى القيم لقطر الكوز والمحصول الحيوى ومحصول القش الميسر بالارض بعد حصاد الذرة مقارنة بالماء الممغنط . اظهر التفاعل بين الماء الممغنط وصورة السماد الازوتى ان استخدام الماء الممغنط فى الرى ادى الى نقص معدل الاستفادة من سماد سلفات الامونيوم بينما ادى الى زيادة معدل الاستفادة من نترات الامونيوم