IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS)
e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 8, Issue 9 Ver. II (Sep. 2015), PP 43-50
www.iosrjournals.org

Impact of magnetic on metal uptake, quality and productivity in onion crop

El Sagan, M. A. M. – Abd El Baset A.
Plant Production Department – Desert Research Center.

Abstract: *The field work was carried out at the Experimental Farm of the Desert Research Center, Balosa region, North Sinai Governorate, during two winter seasons of 2013/2014 and 2014/2015. The experiments were conducted to investigate the effect of magnetized water and nitrogen rate of 60, 90 and 120 Kg (N)/fed on growth, yield and chemical composition of onion variety Giza Red grown in sandy soil. Result revealed that growth parameters, chlorophyll contents, yield and its components chemical contents increased with magnetic water when compared with non magnetized water. Nitrogen at rate of 100% (120kg/fed) significantly enhanced all the investigated growth parameters and highest values in bulb diameters, bulb weight and dry matter percentage, total soluble soiled, total yield and marketable yield percentage and, also increased N, P, K (%) and total protein in both growing seasons. Moreover, the interaction between magnetic water and nitrogen rates showed that the plants irrigated with magnetic water and fertilized by 100% (120 kg/fed.) of nitrogen showed significant and highest values of plant weight and total yield (ton/fed.) followed by non magnetized water with nitrogen at rate of 100% (120 kg/fed.) and magnetic water with nitrogen at rate of 75% (90 kg/fed.) no significant difference in both growing seasons.*

A linear correlation showed that average bulb diameter (cm) and weigh (gm) were positively correlated with number of leaves per plant. Also, total yield was positively correlated with either plant weight or number of leaves/ plant.

In general, it might be concluded that irrigation with magnetic water proved to be good technology to enhance growth, yield and quality when compare with non magnetized water. In addition we can save nitrogen application at rate of 75% (90 kg/fed.) from recommended dose by using magnetized water to reduce pollution and save money.

Key word: *Onion - Magnetic Water – Growth – Yield – Chemical content – Heavy metal*

I. Introduction

Onion (*Allium cepa* L.) is one of the most important vegetable crops grown in the world. In Egypt, it is ranked as the third important vegetable crops after tomato and potato according to annual production (2024881 ton) **FAOSTAT (2012).**

A great challenge for the agricultural sector is to produce more food from desert lands and less water, particularly in the arid and semi-arid regions which is suffering from water scarcity. Utilization of magnetized water technology is considered as a promising technique to improve water use efficiency and crop productivity.

Irrigation with magnetized water induced positive significant effect on growth parameters, chemical constituents and productivity of chickpea **(Mahmoud and Amira, 2010).** Also**,** the irrigation by magnetized water increased significantly plant height, no. of leaves / plant, fresh and dry weight, as well as survival rate, N and P% than those irrigated by non- magnetized water on pear seedlings **Osman et al, (2014),** in tomato **(Carbonell, 2011**and **Ahmed 2013).** In addition, the magnetized water increased the chemical constituents (chlorophyll a and b, carotenoids, total available carbohydrates, protein, total amino acids, proline contents, total indole, total phenol, and inorganic minerals K+, Ca+2 and P+3 contents) in all plant parts of broad bean (**El Sayed, 2015)** and in pepper plants **Rawabdeh et al, (2014).**

De souza et al (2005) reported that at the fruit maturity stage, the magnetically treated seeds produced plants with significantly more fruits (17.9-21.3%); greater mean fruit weight (22.3-25.5%); with a greater fruit yield per plant (47.3-51.7%) and per area (48.6-50.8%) than untreated plants. Moreover, magnetic treatments for both tomato seeds and irrigation water under 75% (90 kg/fed.) or 100% (120 kg/fed.) (120 kg/fed.) NPK of recommended levels gave the best results **Abou El-Yazied et al. (2012).** Also, magnetized water increases plant metabolism in terms of photosynthesis and water uptake (**Yano et al., 2004**).

Plants raised from magnetically treated seeds grew higher and heavier (**Florez et al., 2007)**. Moreover, magnetized water improved plant tolerance to salt stress conditions **Lihua and Jixun (2001)** as well as, stimulation of synthesis and transport of hormones and enzymes metabolism and increase the final plant yield, **Esitken (2003)**.

Mineral fertilizers are one of the principle factors that materially set up onion growth and production. **Yaso et al. (2007)** revealed that increasing mineral nitrogen levels led to significant increases in plant height, number of leaves, average bulb weight, marketable and total bulbs yield, and total soluble solid (TSS) in onion. **Fatideh and Asil (2012)** reported that using 150 kg/ha nitrogen produced higher bulbs weigh, dry matter and yield. **Soleymani and Shahrajabian (2012)** found that maximum bulb diameter, height and weight, beside total yield was related with application of 200 kg N/ha, and there were no significant differences between 200 or 300 kg N/ha.

Nasreen et al. (2007) revealed that addition of nitrogen and sulphur fertilizers exerted significant influence on the number of leaves/plant, plant height, diameter of bulb, single bulb weight, yield of onion and nitrogen and sulphur content in bulbs. Total marketable yield, as well as, total soluble solids (TSS%) were also increased with increasing the rates of nitrogen and sulphur up to 200 kg N/ha and 100 kg S/ha (**Ahmad and Fraihat, 2009).** Moreover, nitrogen affected positively and significantly on plant height and produced the bulbs of greatest marketable yield, and total bulb yield (**Simon et al. 2014).**

II. Materials and Methods

The field work was carried out at Baloza Station of the Desert Research Center, North Sinai Governorate, during the two consecutive winter seasons of 2013/2014 and 2014/2015. The experiments were conducted to study the response of onion plants Giza Red cv. grown in sandy soil to magnetized irrigation water application and of nitrogen fertilization rates. Six treatments were used which were the combination of two water treatment *i.e.*, magnetic water (**MW**), and non magnetized water (**NMW**) and three levels of nitrogen *i.e.* N 50% (60 kg/fed.), N75% (90 kg/fed.) and N100% (120 kg/fed.).

The physical and chemical soil characteristics of the studied site were determined according to **Page *et al.* (1982)** and **Klute (1986)** respectively, as recorded in Table (1). The chemical analysis of irrigation water was carried out using the standard method of **Page *et al.* (1982)** and presented in Table (2). In addition, the magnetic field treatments, irrigation water passed through a magnetic device, the device comprised of two magnets, arranged to the north and south poles. The directions of magnetic field generated at the flow rate diameter 2 inch the device is supplied by Nefertari Biomagnetic company and installed on the main irrigation line before the application to the plants.

Table (1): Physical and chemical properties of the experimental soil.

Particle size distribution (%)			Texture soil	Ec dsm^{-1}	pH	Available nutrients (Cations)					Available nutrients (Anions)			
Sand	Silt	Clay				Na %	P %	K %	Ca meg/l	Mg meg/l	CO3	HCO3 meg/l	Cl^-	$So^{=}_4$
90	**5**	**5**	**sandy**	**1.37**	**8.20**	**4.78**	**0.42**	**0.54**	**3.65**	**4.40**	**-**	**3.85**	**3.3**	**6.5**

Table (2). Chemical analysis of irrigation water.

Samples	pH	E.C. (ppm)	S.A.R	Soluble cations (me/l)				Soluble anions (me/l)			
				Ca^{++}	Mg^{++}	Na^+	K^+	$CO_3^=$	HCO_3^-	$SO_4^=$	Cl^-
1 st. season	7.45	1456	3.80	2.90	3.20	8.60	0.60	0.10	5.60	2.10	7.50
2 nd. season	7.10	1512	3.52	3.25	3.05	9.50	0.40	0.50	3.81	3.69	8.20

pH: Acidity, E.C.: Electrical conductivity, dSm^{-1}: decSiemen per meter, S.A.R: Sodium adsorption ratio, me/l: mille equivalent per liter

Organic manure was added at the rate of 30 m³/fed., while calcium super-phosphate (15.5% P2O5) at the rate of 300 kg /fed., were added during land preparation. Potassium sulphate (48% K2O) at the rate of 200 kg/fed. fertilizer quantities were divided and applied within drip irrigation system starting after 60 days from transplanting to end of maturity, while Nitrogen fertilizer was added as ammonium sulphate (20.5% N) at the rate of 60, 90 and 120 Kg(N)/fed. quantities were divided and applied to the soil until 15 days from transplanting to until maturity. Onion seedlings were sown on two side of ridge, in three lines in etch side and irrigated with drip irrigation system. The ridges were 70 cm apart among drip irrigation lines. Each experimental plot consisted of three ridges with a net area of 32 m² (4m long X 8m wide). Onion seedlings were planted on 1st of December in both growing seasons. All agricultural practices for onion crop production were followed according to the recommendation of Egyptian Ministry of Agriculture.

Growth parameters of vegetative growth:

After 100 days from transplanting, nine plants of each replicate were randomly taken for recording vegetative growth characteristics, (*i.e.*, plant height and weight, number of leaves/plant and percentage of dry weight of the aerial vegetative parts).

Yield parameters and its components:

At harvesting stage (150 days from transplanting date), a sample of 20 onion plants randomly taken from each experimental plot for yield characteristics, *i.e.,* neck and head diameter, blubbing ratio, average bulb fresh weight, and percentage dry matter of bulb were recorded. In addition, total yield (ton/fed.) and percentage of marketable yield, double bulb and flowering plants had been measured. **Chemical component:**

Three samples of onion bulb from each subplot were taken and oven dried at 70ºC until stable weight then grinded to fine particles and used to determine chemical contents such as mineral contents (N, P and K), Phosphorus was determined using the colorimetric method for phosphorus content using spectrophotometer according to **Cottenie *et al.*,(1982)**, Total nitrogen was determined using the modified micro Kjeldahl method, Potassium percentage was measured using flame photometer method as described by **Brown and Lilliland (1964)**. Also, Heavy metals content (Ni, Cr, Cu and Fe) were determined using Inductively Coupled Argon Plasma, iCAP 6500 Duo, Thermo Scientific, England. 1000 mg/l multi-element certified standard solution, Merck Germany was used as stock solution for instrument standardization.

Experimental design and statistical analysis:

The experimental treatments were arranged in split plot design with four replicates, the main plots were assigned for water treatments, whereas, nitrogen rates were randomly arranged in the sub plots. Statistical analyses of obtained data were analyzed at the level of 5% significance according to **Thomas and Hills (1975).**

III. Results and Discussion

Growth parameters:

The obtained data present in Table (3) revealed that there were significantly differences between water treatments. Irrigation with magnetized water induced positive significant effect on plant height and weight, number of leaves/plant and chlorophyll content. While irrigation with non magnetized water surpassed significantly on dry matter percentage of shoot in both growing seasons. The stimulatory effect of the application of magnetic water on the growth parameters reported in this study may be attributed to the increase in photosynthetic pigments, endogenous promoters (IAA) (**Fomicheva et al. 1992 a & b).** Also, **Belyavskaya (2001)** reported that magnetic water significantly induces cell metabolism and mitosis meristematic cells of pea, lentil and flax, as well as stimulated synthesis and transport of hormones and enzymes metabolism and increased growth **(Esitken 2003)**.

As for, the effect of nitrogen rates on onion growth parameters, data presented in Table (3) showed that nitrogen application at rate of 100% (120 kg/fed.) significantly enhanced all the investigated growth parameters, except dry matter percentage of shoot recorded with nitrogen at rate of 50% (60 kg/fed.) of recommended dose. The increase of plant parameters with N application might be due to the increasing of vegetative growth with increasing N rat, this could be due to increase in N supply leads utilization of carbohydrate to form protoplasm and more cells and enhance growth, plants deficiency of N show decreased cell division and expansion (**Yaso et al. 2007)**

Table (3): Effect of magnetic water and Nitrogen rates on plant height, plant weight, number of leaves/plant, chlorophyll contents and shoot dry matter percentage of onion plants during 2013/2014 and 2014/2015 growing seasons.

season	2013/2014														
Characters	**Plant height (cm)**			**Plant weight (gm)**			**No. of leaves**			**Chlorophyll**			**Shoot dry (%)**		
Water treat. / Nitrogen	MW	NMW	X⁻	MW	NMW	X⁻	MW	NMW	X⁻	MW	NMW	X⁻	MW	NMW	X⁻
50% N	65.4	57.7	**61.5**	145.3	141.1	**143.2**	9.0	7.3	**8.1**	51.3	48.3	**49.8**	20.7	23.5	**22.1**
75% N	84.7	73.8	**79.3**	210.3	176.5	**193.4**	11.3	9.0	**10.1**	59.1	52.0	**55.6**	19.1	22.6	**20.9**
100% N	92.9	86.9	**89.9**	242.4	204.4	**223.4**	13.0	12.0	**12.5**	60.8	59.7	**60.2**	16.4	19.8	**18.1**
X⁻	**81.0**	**72.8**		**199.3**	**174.0**		**11.1**	**9.4**		**57.0**	**53.3**		**18.7**	**22.0**	
	2014/2015														
50% N	85.8	73.4	**79.6**	162.4	156.1	**159.3**	10.0	8.8	**9.4**	52.4	48.5	**50.4**	18.5	22.3	**20.4**
75% N	98.5	87.2	**92.8**	264.1	179.8	**221.9**	12.0	10.0	**11.0**	61.8	57.0	**59.4**	17.9	21.0	**19.4**
100% N	99.1	98.7	**98.9**	292.8	255.8	**274.3**	14.0	12.0	**13.0**	65.3	62.6	**64.0**	14.7	20.0	**17.4**
X⁻	**94.5**	**86.4**		**239.8**	**197.3**		**12.0**	**10.3**		**59.8**	**56.0**		**17.0**	**21.1**	
L.S.D at 0.05		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**
Water treat.		4.94	5.40		24.72	15.40		0.750	1.176		3.05	1.23		1.74	2.34
Nitrogen		5.20	5.75		14.29	14.09		1.464	1.170		2.38	2.77		1.47	1.95
W. X N.		**NS**	**NS**		20.21	19.93		**NS**	**NS**		3.37	**NS**		**NS**	**NS**

The interaction between water treatments and nitrogen application as presented in Table (3) showed that no significant effect on growth parameters, except, the plants irrigated with magnetic water and take 100% (120 kg/fed.) of (recommended dose) nitrogen showed the highest values in plant weight, followed by plants which were take 75% (90 kg/fed.) of nitrogen and irrigated with magnetized water and plants which were take 100% (120 kg/fed.) nitrogen and irrigated by non magnetized water in both growing seasons. Moreover, the same trend was observed on chlorophyll content in the first season only.

Bulb and yield parameters:

It was quite evident from Tables (4-5) that irrigation with magnetic water significantly improved neck and bulb diameters, bulb weight and dry matter percentage, total soluble soiled, total yield and marketable yield percentage than plant irrigated with non magnetized water which was increased flowering bulb percentage. Obtained results agreed with those found **by (Hozayn 2010, Mahmoud and Amira, 2010;Carbonell, 2011**; **Ahmed 2013** and **Rawabdeh *et al*, 2014).**

Data presented in Tables (4-5) showed that nitrogen application at rate 100% (120 kg/fed.) had positive effect decreased flowering bulb and increased neck and bulb diameters, bulb weight and dry matter percentage total soluble solids, doubles bulb (%), total yield and marketable yield percentage in both growing seasons. This results in the same line with those obtained by **Nasreen *et al*. (2007)**; **Ahmad and Fraihat (2009)** and **Simon (2014).** No significant differences between values with addition of 75 (90 kg/fed.) and 100% (120 kg/fed. N) in neck diameter, bulb dry matter percentage in both growing seasons. While bulb diameters, total soluble solids, doubles bulb and marketable yield percentage have no significant differences in the second season only. These results agree with those obtained by **Soleymani and Shahrajabian (2012).** They revealed that the maximum bulb diameter, height and weight, total yield and favorite yield was related to application of 200 kg N/ha, and there were no significant differences between in values 200 or 300 kg N/ha application.

Furthermore, the interaction between magnetic water and nitrogen rates showed no significant effect in all parameters except total yield (ton/fed.), it is clear from Table (5) that magnetic water combined with nitrogen at rate of 100% (120 kg/fed.) had the significant improvement in studied characters followed by non magnetized water with the same rate of nitrogen, also magnetic water with nitrogen at rate 75% (90 kg/fed.) in both growing seasons.

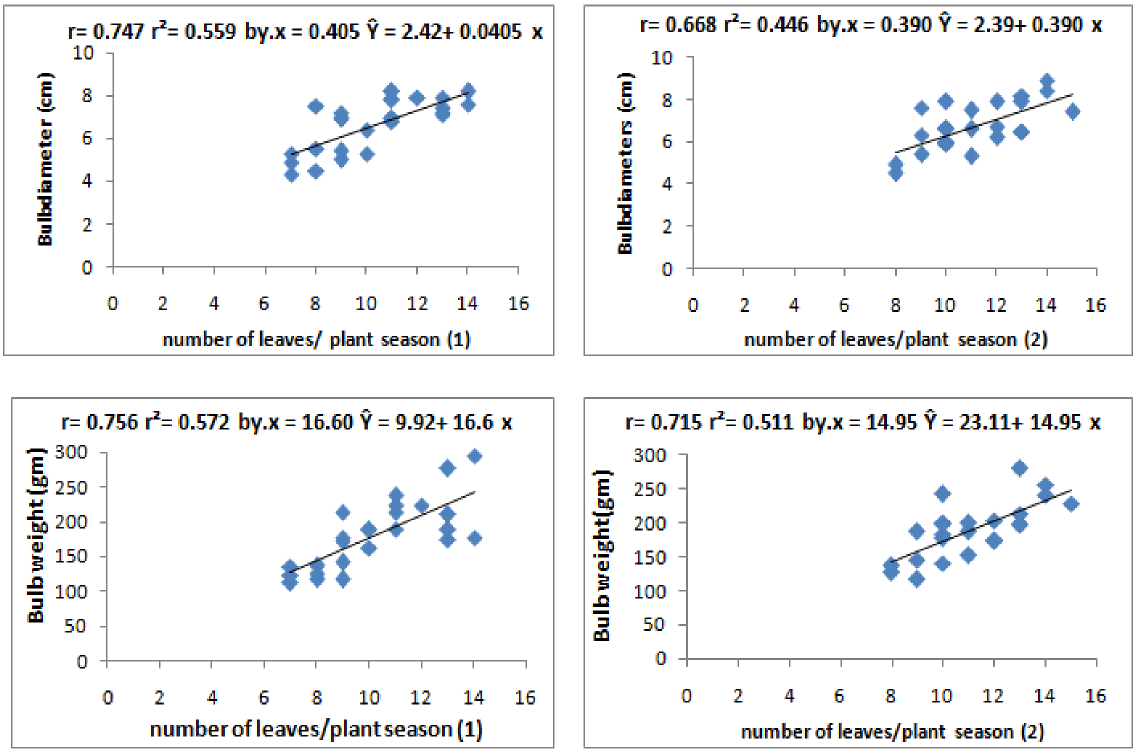
Table (4): Effect of magnetic water and nitrogen rates on neck and bulb diameters, blubbing ratio, bulb weight and bulb dry matter percentage of onion plants during 2013/2014 and 2014/2015 growing seasons.

season	2013/2014														
Characters	Neck diameters (cm)			Bulb diameters (cm)			Blubbing ratio			bulb weight(gm)			Bulb dry matter (%)		
W. treat. / Nitrogen	MW	NMW	$\bar{X}$	MW	NMW	$\bar{X}$	MW	NMW	$\bar{X}$	MW	NMW	$\bar{X}$	MW	NMW	$\bar{X}$
50% N	1.48	1.45	**1.46**	5.30	4.75	**5.03**	0.27	0.309	**0.294**	139.2	122.0	**130.6**	18.80	17.98	**18.39**
75% N	1.88	1.75	**1.81**	7.25	7.00	**7.13**	0.25	0.251	**0.255**	200.2	165.4	**182.8**	19.80	19.35	**19.58**
100% N	2.13	1.85	**1.99**	7.98	7.25	**7.61**	0.26	0.256	**0.261**	246.0	208.2	**227.1**	21.20	19.93	**20.56**
$\bar{X}$	**1.83**	**1.68**		**6.84**	**6.33**		**26.8**	**27.2**		**195.1**	**165.2**		**19.93**	**19.08**	
	2014/2015														
50% N	1.58	1.40	**1.49**	5.65	5.58	**5.61**	0.28	0.263	**0.272**	170	129.8	**150.0**	19.0	18.60	**18.81**
75% N	1.83	1.55	**1.69**	7.15	6.68	**6.91**	0.25	0.235	**0.246**	193	186.8	**189.9**	20.4	19.73	**20.06**
100% N	1.93	1.83	**1.88**	8.23	7.13	**7.68**	0.23	0.258	**0.247**	234	223.1	**228.6**	22.1	19.45	**20.78**
$\bar{X}$	**1.78**	**1.59**		**7.01**	**6.46**		**0.25**	**0.252**		**199**	**179.9**		**20.5**	**19.26**	
L.S.D at 0.05		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**
W. treat.		0.14	0.13		0.51	0.46		**NS**	**NS**		21.47	16.39		0.588	1.21
Nitrogen		0.24	0.25		0.44	0.94		**NS**	**NS**		32.13	27.26		1.049	1.20
W. X N.		**NS**	**NS**		**NS**	**NS**		**NS**	**NS**		**NS**	**NS**		**NS**	**NS**

Table (5): Effect of magnetic water and Nitrogen rates on total yield, marketable yield, percentage of doubles and flowering bulb and T.S.S. of onion plants during 2013/2014 and 2014/2015 growing seasons.

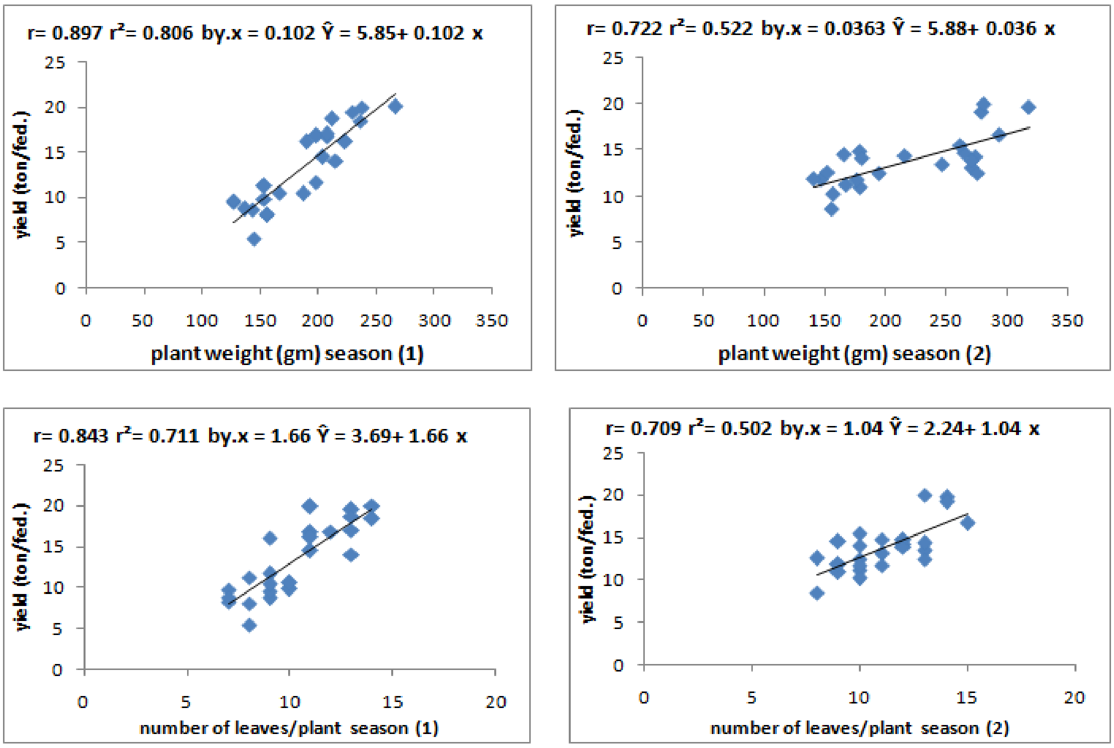
season	2013/2014														
Characters	Total yield (ton/fed)			Doubles bulb (%)			Flowering bulb (%)			Marketable yield (%)			T.S.S.		
Water treat. / Nitrogen	MW	NMW	X^-	MW	NMW	X^-	MW	NMW	X^-	MW	NMW	X^-	MW	NMW	X^-
50% N	9.02	8.00	**8.51**	4.40	4.13	**4.26**	15.4	18.5	**17.0**	78.8	72.9	**75.8**	13.0	11.7	**12.3**
75% N	15.36	10.96	**13.16**	5.98	5.60	**5.79**	11.6	12.1	**11.9**	81.4	77.8	**79.6**	13.6	13.4	**13.5**
100% N	19.46	17.14	**18.30**	8.33	7.65	**7.99**	9.1	10.4	**9.7**	84.8	80.1	**82.4**	15.7	14.3	**15.0**
X^-	**14.61**	**12.03**		**6.23**	**5.79**		**12.1**	**13.7**		**81.6**	**76.9**		**14.1**	**13.1**	
	2014/2015														
50% N	11.03	11.16	**11.09**	5.48	4.05	**4.76**	14.4	17.2	**15.8**	76.3	75.2	**75.7**	13.9	12.6	**13.3**
75% N	13.86	13.98	**13.92**	7.88	6.60	**7.24**	12.7	15.1	**13.9**	79.5	74.8	**77.1**	15.0	14.7	**14.9**
100% N	18.90	14.04	**16.47**	8.68	8.13	**8.40**	8.6	11.2	**9.9**	83.8	77.1	**80.4**	15.8	15.0	**15.4**
X^-	**14.60**	**13.06**		**7.34**	**6.26**		**11.9**	**14.5**		**79.8**	**75.7**		**14.9**	**14.1**	
L.S.D at 0.05		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**
Water treat.		0.77	1.31		**NS**	**NS**		1.10	1.72		2.04	2.95		0.74	0.74
Nitrogen		1.33	1.20		1.31	0.94		1.54	1.97		1.48	3.50		0.82	0.72
W. X N.		1.88	1.70		**NS**	**NS**		**NS**	**NS**		**NS**	**NS**		**NS**	**NS**

It is great important to now in how far the different investigated parameters are correlated of each other. It can be seen from Fig. (1) That bulb diameter (cm) and weigh (gm) was significantly correlated with number of leaves/plant. Correlation coefficients (r) were 0.747 or 0.668 and 0.756 or 0.715 in the first and second seasons, respectively. Corresponding coefficients of determination (r^2) were 0.559 or 0.446 and 0.572 or 0.511, indicating that 55.9% to 44.6% of the variation in bulb diameter or 57.2% to 51.1% of the variation in bulb weight was related to the number of leaves per plant. On the other hand, the regression coefficients (b) were 0.405 or 0.390 and 16.60 or 14.95 in the first and second seasons, respectively. This indicated that with each increased of one leaf /plant, bulb diameter corresponding increased by 0.405 or 0.390 (cm) and bulb weight corresponding increased by 16.60 or 14.95 (gm).



Fig(1): Linear regression (b), correlation coefficients (r), coefficients of determination (r^2) and regression coefficient of bulb diameter (cm) on number of leaves/plant and bulb weight (gm) on No. of leaves/plant.

Moreover, the highly significant positive correlations were existed between total yield (ton/fed.) and either plant weight or number of leaves/plant (Fig.2). A linear regression showed that for each increase of one gram of plant weight, total yield correspondingly increased by 0.102 and 0.0363 ton/fed. in the first and second seasons, respectively. Also, for each increase of one leaf per plant, total yield correspondingly increased by 1.66 and 1.04 ton/fed. in the first and second seasons, respectively.



Fig(2): Linear regression(b), correlation coefficients (r), coefficients of determination (r^2) and regression coefficient of total yield (ton/fed.) on plant weight, number of leaves/plant and bulb weight (gm).

Chemical constituents:

The magnetically treated water had significant increase in N, P, K (%) and total protein and decreased Ni and Cu content in onion bulb. It is clear that from Table (6-7) plants which were irrigated with magnetized water attained significantly high nutrients content in terms of which represented by nitrogen, phosphorus and potassium and total protein compared with the control treatment in both growing seasons. Those results agreed with those obtained by **Osman et al. (2014)** and **El Sayed (2015).** Such increment in minerals constituent as affected by magnetic water may be due to the hydrogen bond in liquid water is highly affected by electrical and magnetic fields. Therefore, the magnetized water has different chemical and physical properties and increased minerals solubility than non magnetized water treatment **Khazan and Abdullatif (2009).** It was noticed that, irrigation with magnetically treated water lead to an increase in most elements content. This is because the elements are diamagnetic which are repelled by a magnetic field **(Nave, 2008)**. The increases of essential elements in plants by irrigation with magnetized water lead to increase chlorophyll content. Potassium and phosphorous are needed for the plant cell's chemical reactions, in the formation and movement of carbohydrates, the development of roots which are necessary for the absorption of minerals and water, ATP, basically a molecule of energy and nucleic acids (**Yano *et al.*, 2004 and Taia *et al*.2007).**

Data presented in Tables (6-7) showed that nitrogen application at rate 100% (120 kg/fed.) had positive effect in N, P, K, Fe Cu and total protein content in both growing seasons. This results in the same line with those obtained by **Nasreen *et al.* (2007).**

IV. Conclusion

In general, it might be concluded that irrigation with magnetized water proved to be good technology to enhance growth, yield and quality when compare with non magnetized water. In addition we can save nitrogen application at rate of 75% (90 kg/fed.) from recommended dose by using magnetized water to reduce pollution and save money.

Table (6): Effect of magnetic water and Nitrogen rates on N, P, K, total protein and carbohydrates of onion plants during 2013/2014 and 2014/2015 growing seasons.

Season	**2013/2014**											
Characters	**N (%)**			**P (%)**			**K (%)**			**Total protein**		
Water treat. / Nitrogen	**MW**	**NMW**	**X̄**	**MW**	**NMW**	**X̄**	**MW**	**NMW**	**X̄**	**MW**	**NMW**	**X̄**
50% N	1.83	1.58	**1.70**	0.421	0.383	**0.402**	0.23	0.21	**0.22**	11.37	9.81	**10.59**
75% N	2.20	2.03	**2.11**	0.430	0.440	**0.435**	0.28	0.24	**0.26**	13.71	12.62	**13.16**
100% N	2.60	2.25	**2.43**	0.518	0.461	**0.489**	0.29	0.26	**0.27**	16.20	14.02	**15.11**
X̄	**2.21**	**1.95**		**0.456**	**0.428**		**0.26**	**0.24**		**13.76**	**12.15**	
	2014/2015											
50% N	1.80	1.48	**1.64**	0.414	0.373	**0.394**	0.24	0.22	**0.23**	11.21	9.19	**10.20**
75% N	2.25	2.00	**2.12**	0.479	0.451	**0.465**	0.29	0.25	**0.27**	14.02	12.43	**13.22**
100% N	2.75	2.25	**2.50**	0.561	0.512	**0.536**	0.29	0.27	**0.28**	17.13	14.02	**15.58**
X̄	**2.27**	**1.91**		**0.485**	**0.445**		**0.27**	**0.24**		**14.12**	**11.88**	
L.S.Dat 0.05		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**		**Sea(1)**	**Sea(2)**
Water treat.		0.180	0.353		0.025	0.032		0.004	0.016		1.12	2.20
Nitrogen		0.271	0.151		0.032	0.038		0.039	0.037		1.69	0.94
W. X N.		**NS**	**NS**		**NS**	**NS**		**NS**	**NS**		**NS**	**NS**

Table (7): Effect of magnetic water and Nitrogen rates on Ni, Fe, Cr and Cu of onion plants during 2013/2014 and 2014/2015 growing seasons.

season	**2013/2014**											
Characters	**Ni (ppm)**			**Fe (ppm)**			**Cr (ppm)**			**Cu (ppm)**		
Water treat. / Nitrogen	**MW**	**NMW**	**X̄**	**MW**	**NMW**	**X̄**	**MW**	**NMW**	**X̄**	**MW**	**NMW**	**X̄**
50% N	0.0354	0.038	**0.0371**	2.260	2.060	**2.160**	0.0242	0.0328	**0.0285**	0.0134	0.0144	**0.0139**
75% N	0.0344	0.034	**0.0344**	2.290	2.435	**2.363**	0.0284	0.0304	**0.0294**	0.0133	0.0148	**0.0140**
100% N	0.0353	0.039	**0.0373**	2.536	2.660	**2.598**	0.0263	0.0314	**0.0288**	0.0134	0.0173	**0.0153**
X̄	**0.0350**	**0.037**		**2.362**	**2.385**		**0.0263**	**0.0315**		**0.0133**	**0.0155**	
2014/2015												
50% N	0.0360	0.0388	**0.0374**	2.260	2.020	**2.140**	0.0298	0.0318	**0.0308**	0.0131	0.0142	**0.0136**
75% N	0.0343	0.0358	**0.0350**	2.265	2.400	**2.333**	0.0280	0.0318	**0.0299**	0.0138	0.0140	**0.0139**
100% N	0.0347	0.0387	**0.0367**	2.465	2.585	**2.525**	0.0269	0.0288	**0.0279**	0.0137	0.0170	**0.0153**
X̄	**0.0350**	**0.0377**		**2.330**	**2.335**		**0.0282**	**0.0308**		**0.0135**	**0.0151**	
L.S.Dat 0.05	**Sea(1)**		**Sea(2)**	**Sea(1)**		**Sea(2)**	**Sea(1)**		**Sea(2)**	**Sea(1)**		**Sea(2)**
Water treat.	0.0004		0.0025	NS		NS	NS		NS	0.0008		0.0005
Nitrogen	0.0021		0.0011	0.217		**0.20**	NS		NS	0.0012		0.0007
W. X N.	NS		NS	NS		NS	NS		NS	0.0017		0.0010

Reference

[1]. A.O.A.C. (1975). Official Methods of Analysis. Twelfth ed. Published by the association of official analytical chemists. Benjamin. Frank line station, Washington. Dc.

[2]. 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.

[3]. Ahmad H. A. F. (2009). Effect of Different Nitrogen and Sulphur Fertilizer Levels on Growth, Yield and Quality of Onion (Allium cepa, L.) Jordan Journal of Agricultural Sciences, Volume 5, No.2.

[4]. Ahmed AM. (2013). Effects of Magnetized Low Quality Water on Some Soil Properties and Plant Growth, Int. J. Res. Chem. Environ. 3 :140-147.

[5]. Belyavskaya, N.A. (2001). Ultrastructure and calcium balance in meristem cells of pea roots exposed to extremely low magnetic field. Adv. Space Res., 28: 4, 645-650.

[6]. Brown, J.D. and O. lilliland (1964). Rapid determination of potassium and sodium in plant material and soil extracts by flame photometer. Proc. Amer.Soc. Hort. Sci., 48: 341-346.

[7]. Carbonell, M.V., Florez, M., Martinez E., Maqueda, R. and J.M. Amaya (2011). Study of stationary magnetic fields on initial growth of pea (Pisum sativum L.) seeds. Seed Science and Technology, 39: 673-679.

[8]. Cottenie, A.; Verloo M.; Kickens L.; Velghe G. and R. Camerlynck, (1982). Chemical analysis of plants and soils. Laboratory of Analytical and Agrochemistry. State University, Ghent Belgium, pp: 63.

[9]. De Souza A., D. García, L. Sueiro, L. Licea and E. Porras (2005) Pre-sowing magnetic treatment of tomato seeds: effects on the growth and yield of plants cultivated late in the season . Spanish Journal of Agricultural Research 3(1), 113-122.

[10]. El Sayed, H. A. El Sayed (2015) Impact of Magnetic Water Irrigation for Improve the Growth, Chemical Composition and Yield Production of Broad Bean (Vicia faba L.) Plant Nature and Science;13(1)

[11]. Esitken, A. (2003). Effects of magnetic fields on yield and growth in strawberry 'Camarosa'. Journal of Horticultural Science & Biotechnology, 78 (2): 145– 147.

[12]. FAOSTAT, (2010). An on-line and multilingual databases currently containing over one million time-series records covering international statistics

[13]. Fatideh, M. M. & M. H. Asil (2012). Onion yield, quality and storability as affected with different soil moisture and nitrogen regimes. South-Western J. of Horti. Biology and Environment, 3(2): 145-165.

[14]. Florez, M.; M.V. Carbonell and E. Martinez (2007). Exposure of maize seeds to stationary magnetic fields: Effects on germination and early growth. Environmental and Experimental Botany, 59:68–75.

[15]. Formicheva, V.M, Govorun, R.D and V.T. Danilov (1992a). Proliferative activity and cell reproduction in the root meristem of pea, lentil and flax in the conditions of screening the geomagnetic field. Int. Biophysics. 37: 645-648.

[16]. Formicheva, V.M, Zaslavskii, V.A, Govorun, R.D. and V.T. Danilov (1992b). Dynamics of RNA and protein synthesis in the cel1s of the root meristems of the pea, lentil and flax Biophysics., 37: 649-656.

[17]. Hala R., S. Shiyab and R. Shibli (2014).The Effect of Irrigation by Magnetically Water on Chlorophyll and Macroelements uptake of Pepper (Capsicum annuum L.).Jordan Journal of Agricultural Sciences, Volume 10, No.2 .

[18]. 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.

[19]. Klute, A. J. (1986). Methods of Soil Analysis. No. (9), Part 1 - Physical and Mineralogical Methods. Am. Soc., Agron., Inc. Soil. Sci., Mad., Wisc., U.S.A.

[20]. Lihua, X. and G. Jixun (2001). Effect of magnetic seed treatment on growth and saline-alkali tolerance of Leymus chine-nsis. Acta Prataculturae Sinica. 10(1): 58-63 (c.f. Cab. Abst. 2002-2003).

[21]. Mahmoud H. and A. MSAQ. (2010). Irrigation with magnetized water enhances growth, chemical constituent and yield of chickpea (Cicerarietinum L.).Agric. And Bio. J. of North Am., 14: 671-676.

[22]. Hozayn M., and Mohamed A. and S. Abdul Qados (2010) Irrigation with magnetized water enhances growth, chemical constituent and yield of chickpea (Cicer arietinum L.).AGRICULTURE AND BIOLOGY JOURNAL OF NORTH AMERICA. ISSN Print: 2151-7517, ISSN Online: 2151-7525.

[23]. Nasreen S., Haque M. M., Hossain M. A. and A. T. M. Farid. (2007) Nutrient uptake and ield of onion as Influence by nitrogen and sulphur fertilization. Bangladesh J. Agril. Res. 32(3) : 413-420.

[24]. Nave, C. L. (2008). Magnetic Properties of Solids. Hyper Phys., 15: 11-23.

[25]. Osman E.A. M., Abd El-Latif K.M, Hussien S.M. 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 pear seedlings.Glob. J. Sci. Res., 2 (5): 128-136, 2014

[26]. Page, A. L., Miller R. H.and D. R. Keeney (1982). Methods of soil analysis. No. (9), Part 2. Chemical and Microbiological Properties. Am. Soc., Agron., Inc. Soil. Sci., Mad., Wisc., U.S.A.

[27]. Rawabdeh, H., Safwan S.and S. Rida (2014). The Effect of Irrigation by Magnetically Water on Chlorophyll and Macroelements uptake of Pepper (Capsicum annuum L.). Jordan Journal of Agricultural Sciences, Volume 10, No.2.

[28]. Simon T., Melese T., Abrham S. and U. Samuel (2014). The Effect of Variety, Nitrogen and Phousphorous Fertilization on Growth and Bulb Yield of Onion (Allium Cepa L.) at Wolaita, Southern Ethiopia. Journal of Biology, Agriculture and Healthcare Vol.4, No.11.

[29]. Soleymani, A. and M. H. Shahrajabian .(2012). Effects of different levels of nitrogen on yield and nitrate content of four spring onion genotypes. Inter. J. of Agric. and Crop Sci., 4(4): 179-182.

[30]. Taia W., Al-Zahrani H. and A. Kotbi (2007). The effect of static magnetic forces on water contents and photosynthetic pigments in sweet basil Ocimum basilicum L. (Lamiaceae). Saudi J Bio Sci, 14:103-7.

[31]. Thomas, M. L. and F.J. Hills (1975). "Statistical methods in Agric. Research" .Univ. of California, davis 956162 d printing, p. 67-74.

[32]. Yano, A., Ohashi, Y., Hirasaki, T. and K. Fujiwara (2004). Effects of 60 Hz magnetic field on photosynthetic uptake and early growth of radish seedlings. Bioelectromagnetics, 25(8): 572-581.

[33]. Yaso, I.A. ; Abdel-Razzak H.S. & M.A. Wahb-Allah .(2007). Influence of biofertilizer and mineral nitrogen on onion growth, yield and quality under reclaimed calcareous soil condition. J. Agric. Env. Alex. Univ., Egypt., 6(1): 245-264.