Journal of Plant Production

Journal homepage: www.jpp.mans.edu.eg
Available online at: www. jpp.journals.ekb.eg

Effect of Magnetized Water and NPK Fertilization Treatments on Growth and Field Performance of Gladiolus

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ABSTRACT

The current investigation was carried out at Vegetables Research Station of Olericulture and Floriculture Dept., Faculty Agric., Mansoura Univ., Egypt, during the season of 2018 and 2019, to study the effect of irrigation water type (magnetized and non-magnetized water), four inorganic NPK fertilizer rates (50, 75, 100 and 125 kg/fed) and their interactions on growth and field performance of gladiolus plant spikes and corms (cv. Rose Supreme) cultured under the conditions of silty loam soil with developed furrow irrigation system. The experiment was laid out as strip-plot design with three replicates. The obtained data of this study obviously indicated that, all tested parameters such as vegetative growth characters (shoots and leaves number/plant, …), leaves chemical composition (N, P, K, …), flowering characteristics (spike number, length and fresh weight, …) and corm yield and its components (corm number, fresh weight and diameter, …) had significantly been influenced with irrigation water type, NPK fertilizer rates and their interaction. Regarding the effect of irrigation water type, the magnetized water gave the maximum values for most forecited parameters, except vegetative growth parameters, characters of spike number and fresh weight and corm diameter as compared with the non-magnetized one. Concerning the impact of NPK fertilizer rate, the rate of 125 kg fed^{-1} recorded significant values for all mentioned parameters compared with 50 kg fed^{-1} of fertilizer rate. Respecting the influence of interaction treatments, the combination treatment between magnetized water and NPK fertilizer rate at 125 kg fed^{-1} had significant effects on all aforementioned studied parameters as compared with interaction treatment between non-magnetized water and 50 kg fed^{-1} of fertilizer rate, therefore, it could be recommended that this interaction treatment is the best one for obtaining high characters of gladiolus growth and field performance of plants under similar research conditions.

Keywords: *Gladiolus hybrida* spikes and corms, magnetized and non-magnetized water, NPK fertilizer, growth and flowering characteristics.

INTRODUCTION

Flowering plants are too substantial group of ornamental plants that employed whether for gardens landscaping or a cut flowers. Gladiolus (*Gladiolus hybrida* cv. Rose Supreme) belongs to the family *Iridaceae* and it is one of the most four famous cut flowers in the world. A genus of perennial cormous flowering plants in the iris family includes about 260 species. The origin of this genus plants was in Mediterranean, Europe, Asia, South and Tropical Africa (Bai *et al*., 2009). Gladioli commercially propagated vegetatively by rounded symmetrical corms, which they generally produce unbranched stems, elongate leaves and big flower spikes. Gladiolus has acquired a great worldwide popularity because of its beautiful and attractive flower spikes, excellent vase life, captivating flower colors and their high feasibility (Bose *et al*., 2003). Among the valuable cut flowers are gladiolus, rose, carnation, marigold, zinnia, static, aster, etc. In the case of gladiolus flowers, market levels differed depending on spike and flowers characteristics (Kurd *et al*., 2008). Gladiolus grow stronger in warm weather circumstances, sufficient availability of water through the field cycle, soil with proper drainage and fertility and soil pH from 5.5 to 6.5 (Al-Humaid, 2004). Consequently, the lack of mentioned growth conditions in proper limits will results in prevention of good growth and field performance of plants, and hence incidence of large losses for gladiolus producers. Magnetic water (MW) is the magnetically treated water or the water that passes through the magnetic field. MW is one of the most significance and environmentally friendly physical factors used as a stimulant for interactions related to plant growth and development. There are preceding investigations showed that irrigation with MW can positively contributes in improving the performance of agricultural crops. Since, it enhances the growth and development of diverse plants quantitatively and qualitatively, ameliorates seeds germination and early emergence and development of seedlings, increases crop quantity and quality, improves water use efficiency, enhances the irrigation water quality (*i.e.*, surface tension, conductivity and salts solubility), reduces consumptive use and soil pH, increases solubility, mobility and uptake of applied fertilizers by plant roots and depresses the cost of farm procedures (Abobatta, 2019). Amira *et al.* (2010) in pot greenhouse experiments found that the common flax vegetative growth, yield, photosynthetic pigment content and proteins were increased when plants were irrigated with MW comparing the plants that irrigated with tap water only. Also, in a pot experiment, Sadeghipour and Aghaei (2013) reported that fifty days after sowing of cowpea seeds, the growth of developed plants were improved when cultured seeds were irrigated with MW. Similar improving impacts were gained by Dawa *et al.* (2017) and Yusuf and Ogunlela (2017) on tomato plants, Moussa (2011) on common bean, Hozayn *et al.* (2013)

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DOI: 10.21608/jpp.2020.110558

on sugar beet, El Sayed (2014) on broad bean and Abdel Nabi *et al.* (2017) on head lettuce.

Soil minerals do not contain enough and available quantities of NPK elements. These essential macro-nutrients may be lost from the soil-plant environment by divers paths, including volatilization, denitrification, leaching (chiefly NO_3^--N) and soil erosion (mainly NH_4^+-N) in the case of N or in fixed and adsorbed form with P or in fixed style within the stratums of some kinds of clay minerals or in unavailable style within the crystalline construction of soil minerals in the case of K (Gianquinto *et al*., 2013). Hence, deficient or excessive or imbalanced amounts of NPK elements will result in several a biotic and some biotic stresses which they will cause unsatisfactory growth and field performance of economic crop parts. Otherwise, the appropriate plant nutrition which including balanced and sufficient NPK fertilizer amounts, suitable styles and proper additions times through growth season are essential components influencing growth, flower spikes and corms production and quality of gladiolus.

Nitrogen (N) is an essential major element of several significant organic components, *e.g*., amino acids, proteins, purine bases, amino enzymes, nucleotides, some B complex vitamins, DNA, RNA and chlorophylls that are very required ingredients for all plant metabolic processes. Also, N improves plant growth, flowering, and productivity and enhances the assimilation flow to economic plant parts.

Phosphorus (P) is a necessary element of some enzymes and proteins, nucleic acids, phytin and ATP molecules. Since, P is an essential for transferring of energy and storage in plant metabolism. Hence it is required for photosynthesis, respiration and biosynthesis of diverse organic compounds, such as nucleic acids and sugars. As well, P is accompanied with coenzymes, phospholipids, nucleotides, carbohydrates and storage compounds. Furthermore, P is needed for production of strong and active plant root system.

Potassium (K) is an constituent for plant life, since it has several principal regulatory functions in plant development containing; activation of large number of enzymatic reactions, synthesis of cellulose and lignin which needed for formation of cellular structural components, improvement of photosynthesis, formation of proteins and carbohydrates required for different plant metabolic processes, speeding up transportation of assimilates from the leaves to plant storage tissues, which result in enhancement of quality characters. Also, K improves water-use efficiency by regulating water loss from plants through controlling stomata closing and opening processes (Marschner, 2012 and Gianquinto *et al*., 2013).

Adding of N and P at 175+200 kg/ha had significant response on gladiolus leaves number and length, florets number/spike, corms number/plant, cormlets number/corm and spike length (Lehri *et al*., 2011). Khan *et al.* (2012) indicated that N, P, and K largely affect the growth, flowering and tuber productivity of tuberose. Zubair *et al.* (2013) investigated the effect of three N levels, *namely,* 0,100 and 200 kg/ha on yield and quality of gladiolus cut flowers and corm production and mentioned that N did not reveal a significant influence on most of yield and quality parameters, except on the first florets size which was increased with increasing N level. Likewise, El-Naggar and El-Nasharty (2016) revealed that foliar application of 2% K in the form of K_2SO_4 (48% K_2O) in combination with 100% of soil amended K have realized the highest significant means of gladiolus vegetative growth and flowering parameters, corm and cormels characters and content of leaf chlorophyll a and b and petals anthocyanins as compared to the other foliar K applied at 1% alone or in accompanied with K soil dressing at 50% and 75%. Kumar *et al.* (2017) reported that among four rates of N (0, 40, 60 and 80 kg/acre), applying 60 kg/acre can enhance the vegetative growth, flowering, yield and vase life parameters of gladiolus.

Therefore, the aim of this study was to investigate the impact of magnetic water and NPK fertilization treatments on enhancement of growth, productivity and characteristics of gladiolus spikes and cormes and earliness of spikes yield in order to benefit from the higher prices at the beginning of the production season.

MATERIALS AND METHODS

The present study was conducted in Research Vegetable Farm, Faculty Agric., Mansoura Univ., Egypt during winter season of 2017/2018 to find out the influence of irrigation water type (*i.e*., magnetized and non-magnetized water) and four inorganic NPK fertilizer levels and their interactions on growth, flowering and yield of gladiolus plant (cv. Rose Supreme) grown in silty loam soil with ameliorated furrow irrigation manner (El-Saady, 2016). Physical and chemical attributes of the cultured soil are shown in Table (1).

Table 1. Physical and chemical measurements of the cultivated soil during 2017/2018 season.

Soil characters	Clay %	Silt %	Sand %	Texture	pH	SP	EC (dSm^{-1})	Organic matter %	$CaCO_3$ %	Available (mg/ kg) N	P	K
2017/18 season	15.93	29.44	54.63	Silty loam	7.91	46.3	1.29	1.94	4.39	40.5	5.11	146.2

SP: Saturation percentage

Two irrigation water types, *i.e*., magnetized and non-magnetized water were used in this investigation. Where, both irrigation water types were reached to the experimental units by improved furrow irrigation method through two lines (63 mm in diameter) of black polyethylene plastic pipes including four PVC valves (63 mm in diameter) for each line as described by El-Saady (2016).

Three commercial inorganic NPK fertilizers, *namely*, ammonium sulphate (20.5 % N), granulated calcium super phosphate (12.5 % P_2O_5) and potassium sulphate (50 % K_2O), respectively, were applied at various four fertilizer levels (50, 75, 100 and 125 kg/fed.) of the fertilizer ratio (1:1:1) for preparing diverse four fertilizer treatments. Consequently, the applied quantities of commercial NPK fertilizers required/fed in the diverse four fertilization treatments were exactly calculated and shown in Table (2).

Table 2. Quantities of commercial NPK fertilizers employed in the diverse fertilization applications as kg /fed.

Fertilization treatments		commercial mineral fertilizers		
Fertilizer ratio	Fertilizer rates (kg /fed)	Ammonium sulphate (20.5 % N)	Calcium super phosphate (12.5 % P_2O_5)	Potassium sulphate (50 % K_2O)
1:1:1	50	81	133	34
	75	122	200	50
	100	163	267	67
	125	203	333	83

Full dose of phosphorus and potassium and third of nitrogen was added as a basal dose at the time of corms planting. Remaining dose of N was applied in two equal splits, 30 and 60 days after planting (DAP) of corms.

The irrigation process was carried out by using Nile River water, which passed with Mansoura city, for several times by 2 weeks intervals of DAP of gladiolus corms. Developed furrow irrigation method through black polyethylene plastic pipes (63 mm in diameter) was used.

Uniform gladiolus corms were used at planting time. One gladiolus corm was planted in hills spaced 35 cm apart on one side of each ridge (60 cm width) in wetted soil on 23th of October in the cultivation season. The plot area was 14.4 m^2, including 6 ridges of 60 cm width and 4 m length and contained 50 corms. All other cultural procedures were done in accordance with the recommendations of Ministry of Agriculture.

Experimental design:

The experiment was laid out as strip-plot design with 3 replications. Where, the vertical plots were allocated to the irrigation water type, whereas the horizontal ones were allotted to NPK fertilizer rates.

Recorded data:

Five plants were randomly selected from each replicate to determine the following parameters:

1- Vegetative growth parameters:

Plant number/corm, plant height and total plant leaves number/corm were recorded at 70 DAP of corms.

2- Leaves chemical components:

The percentage of N, P, K and protein in leaves dry matter and total chlorophyll % in fresh leaves were estimated at 70 DAP according to AOAC (1990).

3- Flowering characteristics:

For determination of spike parameters, the spikes were removed when lower floret began showing color. Number of spike/corm, spike length, spike fresh weight/corm, number of flowers/corm and days to spike emergence were scored throughout the spikes harvest period.

4- Corms yield and its component:

For estimation of corms yield and its components, gladiolus corms were removed in the end of season with a portion of the soil after the leaves were yellowed and before they were completely dry. Number of corms/plant, corms fresh weight/plant, corms diameter, number of cormels/plant and cormels fresh weight/plant were recorded.

Statistical Analysis:

Data were subjected to analysis of variance (ANOVA) method as described by Gomez and Gomez (1984). The treatment means were compared using the least significance differences (LSD) test at 5 % probability level procedure as mentioned by Snedecor and Cochran (1989).

RESULTS AND DISCUSSION

Results:

1- Vegetative growth parameters:

Concerning the impact of irrigation water type (magnetized and non- magnetized water) on gladiolus vegetative growth parameters (*i.e*. shoots number/plant, plant height and leaves number/plant), data presented in Table (3) show that there were no significant difference between magnetized and non-magnetized water for all above vegetative growth parameters. Nevertheless, magnetized water treatment gave higher values for all these traits as compared with non-magnetized water.

Regarding the effect of NPK fertilizer rates, data of Table (3) indicate that NPK fertilizers that added at 125 kg/fed gave significant increments for shoots number/plant and plant leaves number/plant parameters, except plant height one, as compared with the NPK fertilizer rate at 50 kg/fed.

Respecting the influence of interaction between irrigation water type and NPK fertilizer rates, the interaction treatment of magnetized water with NPK fertilizer at 125 kg/fed achieved significant increases for shoots number/plant and leaves number/ plant characters, without significant difference for plant height one, as compared with the rate of 50 kg/fed of NPK fertilizers. Nevertheless, the combination treatment of magnetized water + NPK fertilizer at 125 kg/fed registered the highest values for all mentioned parameters, whereas the lowest values were recorded with the treatment of non-magnetized water + 50 kg/fed of NPK.

Table 3. Effect of magnetized water, NPK fertilizer rates and their interaction on some vegetative growth parameters of gladiolus during 2017/2018 season.

Parameters		Shoots no/plant	Plant height (cm)	Leaves no/plant
Irrigation water type				
Magnetized		1.98	49.69	10.09
Non- Magnetized		1.50	46.69	7.91
F-Test		N.S	N.S	N.S
NPK fertilizer rates (kg fed^{-1})				
50		1.25	45.31	6.75
75		1.50	46.50	8.44
100		1.94	49.25	9.75
125		2.19	51.69	11.06
LSD 5%		0.60	7.88	3.30
Interaction				
Magnetized water	50	1.38	46.13	8.00
	75	1.75	47.88	9.38
	100	2.25	50.75	10.75
	125	2.38	54.00	12.25
Non-magnetized water	50	1.13	44.50	5.50
	75	1.25	45.13	7.50
	100	1.63	47.75	8.75
	125	2.00	49.38	9.88
LSD 5%		0.98	11.52	4.56

2- Leaves chemical composition:

The influence of irrigation water type, inorganic NPK fertilizer levels and their combinations on gladiolus leaves chemical composition, *vis*., total chlorophyll of fresh leaves; N, P, K and crude protein of dry leaves are presented in Table (4).

As for the impact of irrigation water type, the obtained results illustrate that all forecited parameters had significantly been affected by magnetized water as compared with non-magnetized water treatment.

As regards the impact of NPK fertilizer levels, results shown in the same Table (4) clearly indicate that the rate of 125 kg/fed of NPK fertilizers significantly affected all former parameters as compared to lower NPK levels (75 and 50 kg/fed). In this connection, the rate of 125 kg/fed achieved the highest values for above parameters, whereas the lowest values registered with the rate of 50 kg/fed.

Concerning the influence of interaction treatment, the interaction treatment of magnetized water + NPK fertilizers at 125 kg/fed had significant impacts on all aforementioned characters as compared with the combination treatment of non-magnetized water + NPK fertilizers rate of 50 kg/fed.

Table 4. Effect of magnetized water, NPK fertilizer rates and their interaction on leaves chemical components of gladiolus during 2017/2018 season.

Parameters		Fresh leaves: Total chl* (mg/g)	Dry leaves: N (%)	P (%)	K (%)	Protein (%)
Irrigation water type						
Magnetized		6.24	2.93	0.329	2.68	16.82
Non- Magnetized		6.02	2.59	0.249	2.24	14.90
F-Test		*	*	*	*	*
NPK Fertilizer rates (kg fed^{-1})						
50		5.94	2.50	0.190	2.03	14.38
75		6.04	2.63	0.262	2.37	15.10
100		6.19	2.88	0.323	2.67	16.58
125		6.33	3.03	0.381	2.78	17.40
LSD 5%		0.19	0.39	0.082	0.24	2.24
Interaction						
Magnetized water	50	6.02	2.75	0.236	2.40	15.81
	75	6.15	2.85	0.312	2.60	16.39
	100	6.31	2.95	0.345	2.83	16.96
	125	6.47	3.15	0.424	2.90	18.11
Non-magnetized water	50	5.87	2.25	0.143	1.67	12.94
	75	5.94	2.40	0.212	2.13	13.80
	100	6.07	2.82	0.302	2.50	16.20
	125	6.19	2.90	0.338	2.67	16.68
LSD 5%		0.25	0.45	0.118	0.30	2.12

Chl*: Chlorophyll

3- Flowering characteristics:

Data of Table (5) reveal that most of gladiolus flowering characteristics, *i.e.*, spike length, florets number/corm and days to spike emergence, except spike number/corm and spike fresh weight/corm characters were significantly influenced by irrigation water type. In this respect, the maximum means of all former characters were obtained by magnetized water, whereas the lowest records of these characters recorded with non-magnetized water treatment.

As to the impact of added NPK fertilizer rate, results also existed in Table (5) demonstrate that the same mentioned parameters were significantly increased with increasing added NPK fertilizer rate from 50 kg/fed up to 125 kg/fed. In this respect, the best values of all previous characters were attained with the fertilizer rate of 125 kg/fed, whilst 50 kg/fed fertilizer level recorded the worst values of all previous ones.

The most interaction treatments between irrigation water type and most NPK fertilizer rates had significant impacts on all former characters as compared with the combination treatment between non-magnetized water and NPK fertilizer at 50 kg/fed as indicated in Table (5). The best records in this concern were gained with the combination treatment between magnetized water and NPK fertilizer at 125 kg/fed. On the other hand, the worst means were registered with the combination treatment between non-magnetized water and 50 kg/fed of NPK fertilizer.

4- Corms yield and its component:

The influence of irrigation water type, NPK fertilizer rates and their interactions on gladiolus corms yield and its component in terms of corms number; corms fresh weight, corms diameter, cormels number and cormels fresh weight are listed in Table (6). Data of the same Table declare that all preceding attributes had been affected significantly by magnetized water, except corms diameter one, as compared with the non-magnetized water treatment.

Table 5. Effect of magnetized water, NPK fertilizer rates and their interaction on flowering characteristics of gladiolus spikes during 2017/2018 season.

Parameters		Spike no/ corm	Spike length (cm)	Spike FW*/ corm	Florets no/ corm	Days to spike emergence
Irrigation water type						
Magnetized		2.44	78.47	132.85	28.16	96.0
Non- Magnetized		1.88	74.13	106.42	20.31	101.5
F-Test		N.S	*	N.S	*	*
NPK Fertilizer rates (kg fed^{-1})						
50		1.56	72.06	97.12	17.56	107.5
75		1.94	74.88	104.77	20.94	102.5
100		2.38	77.19	127.79	26.94	95.0
125		2.75	81.06	148.88	31.50	90.0
LSD 5%		0.71	6.45	45.97	7.93	1.8
Interaction						
Magnetized water	50	1.75	74.50	107.58	19.25	106.0
	75	2.25	76.50	118.01	24.50	101.0
	100	2.75	79.25	141.40	33.00	92.0
	125	3.00	83.63	164.43	35.88	85.0
Non-magnetized water	50	1.38	69.63	86.67	15.88	109.0
	75	1.63	73.25	91.52	17.38	104.0
	100	2.00	75.13	114.18	20.88	98.0
	125	2.50	78.50	133.32	27.13	95.0
LSD 5%		0.99	8.63	57.75	12.07	2.2

FW*: Fresh weight

Table 6. Effect of magnetized water, NPK fertilizer rates and their interaction on gladiolus corms yield and its component during 2017/2018 season.

Parameters		Corms: No/ plant	FW*/ Plant (g)	diameter (cm)	Cormels: No/ plant	FW*/plant (g)
Irrigation water type						
Magnetized		1.9	38.75	4.85	27.2	2.07
Non- Magnetized		1.5	31.11	4.19	15.5	1.49
F-Test		*	*	N.S	*	*
NPK Fertilizer rates (kg fed^{-1})						
50		1.0	29.15	3.75	11.8	1.19
75		1.5	30.93	4.33	15.7	1.62
100		1.8	38.53	4.87	25.8	1.98
125		2.3	41.11	5.14	32.0	2.34
LSD 5%		0.4	5.50	0.77	3.6	0.35
Interaction						
Magnetized water	50	1.2	31.88	4.17	14.3	1.49
	75	1.7	34.75	4.75	19.7	1.89
	100	2.2	43.20	5.12	34.7	2.36
	125	2.5	45.17	5.38	40.0	2.54
Non-Magnetized water	50	1.0	26.42	3.33	9.2	0.88
	75	1.3	27.12	3.92	11.7	1.35
	100	1.5	33.85	4.62	17.0	1.61
	125	2.0	37.05	4.90	24.0	2.13
LSD 5%		0.5	8.81	1.10	4.7	0.51

FW*: Fresh weight

Respecting the fertilizer level impact, data of Table (6) outline that the forecited parameters, except cormels fresh weight and diameter ones had significantly been increased with increasing NPK fertilizer rate from the minimum level (50 kg/fed) up to the maximum one used (125 kg/fed). However, the rate of 125 kg/fed of NPK fertilizer gave significant increments for all previous traits as compared with the rate of 50 kg/fed.

Data presented in Table (5) apparently show that irrigation water type-NPK fertilizer rates interaction significantly impacted the forecited parameters. The highest values on that score were obtained with magnetized water in accompanied with fertilizer rate of 125 kg/fed treatment. On contrast, the lowest records of the same characters were scored with non-magnetized water in combined with fertilizer rate of 50 kg/fed treatment.

Discussion:

It is clear from the previous presentation of the obtained results related to the impact of magnetized water and NPK fertilizer rates and their interactions on the characteristics of vegetative growth and field performance of the gladiolus plant that there are generally significant positive effects of both these studied factors on most of the estimated parameters, except for plant height one, as well as the traits (plants, leaves and spikes number/corm, spikes fresh weight and corm diameter) with the type of irrigation water.

As for the influence of irrigation water type, the obtained results are in the same line with those of Amira *et al*. (2010) on flax; Moussa (2011) on common bean, Dawa *et al*. (2017) and Yusuf and Ogunlela (2017) on tomato, Hozayn *et al*. (2013) on sugar beet, Sadeghipour and Aghaei (2013) on cowpea, El Sayed (2014) on broad bean, Abdel Nabi *et al*. (2017) on head lettuce and Abobatta (2019) on sugar beet. The stimulatory impact of irrigation with magnetized water may be attributed to ameliorating and increment of free-living micro-organisms population and its efficiency in the soil, which results in increase root development and effectiveness, improves absorbance of water and nutrients and synthesis of plant hormones (Dawa *et al*., 2017) that may be responsible for superior growth of gladiolus. As well, magnetically treated water treatment stimulates the efficiency of plant hormones and bio-enzyme systems, which influence cell membranes structural components and in turn enhances their permeability for water and nutrients, which then affects different plant metabolic activities resulting in increased gladiolus growth, chemical constituents and productivity. In addition, there are some alters take placed in the physical and chemical properties of water as a result of the magnetic treatment, including formation of clustering structures from ring and linear hydrogen bonding, conductivity, surface tension force, polarity of water molecules and solubility of salts (Pang and Deng, 2008). All these modifications in water properties may influence plants growth and development. Altering water and soil properties as a consequence of irrigation water treatment by magnetic field increased the availability, up taking and assimilation of nutrients leading to greater contents of them in plant tissue.

Respecting the impact of mineral NPK fertilizer rates, the acquired results are in agreement with those of Lehri *et al*. (2011); Khan *et al*. (2012), Zubair *et al*. (2013), El-Naggar and El-Nasharty (2016) and Kumar *et al*. (2017) on gladiolus. The increases in growth, spikes and corms yield of gladiolus and its component (flowering and yield parameters of gladiolus) due to supplementation with the best combination treatment between magnetized water and NPK fertilization may be attributed to favorable roles of these factors in promotion of important plant metabolism processes such as photosynthesis and formation of carbohydrates, proteins and other necessary organic constituents which flow and intensify in edible plant parts, *i.e.*, gladiolus spikes and corms by the mechanism of action of these components in this regard, and consequently improvement of gladiolus productivity. In addition, Due to the low nutritional content of experimental soil, especially in its NPK content (Table 1), the high addition rate of these nutrients has compensated the poor soil fertility of them, which led to an increase in the accessible and absorbable quantities of those elements, which resulted in providing the optimum plant requirements of those nutrients. This was reflected in the increment of growth, yield and quality of spikes and corms rates obtained from the gladiolus plants.

CONCLUSION

In order to achieve high plant growth, good field performance parameters of spikes and corms of gladiolus crop (cv. Rose Supreme), it could be concluded that irrigation and fertilization of gladiolus plants with magnetized water and inorganic NPK fertilizers blend (namely, 203 kg ammonium sulphate + 333 kg calcium superphosphate + 83 kg potassium sulphate) which derived from NPK fertilizer at 125 kg/fed for achieving these suitable effects under similar circumstances of this study.

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تأثير الماء الممغنط ومعاملات التسميد النيتروجيني والفوسفاتي والبوتاسي على النمو والسلوك الحقلي للجلاديولس

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أجريت الدراسة الحالية بمحطة بحوث الخضر، كلية الزراعة، جامعة المنصورة، مصر خلال موسم 2019/2018 م، لدراسة تأثير نوع ماء الري (ماء معالج مغناطيسيا وماء غير معالج مغناطيسيا)، وأربع معدلات سمادية معدنية للنيتروجين والفوسفور والبوتاسيوم (50، 75، 100 و125 كجم/فدان) وتفاعلاتهم على النمو والسلوك المحصولي بلغة المحصول والجودة لنورات وكورمات نبات الجلاديولس (صنف روز سوبريم) المنزرع تحت ظروف تربة طميية سلتية تروى بنظام ري سطحي مطور. صممت التجربة في تصميم الشرائح المتعامدة في ثلاث مكررات. حيث خصصت الشرائح الرأسية لنوع ماء الري، في حين خصصت الشرائح الأفقية لمعدلات التسميد بأسمدة النيتروجين والفوسفور والبوتاسيوم. لقد بينت النتائج المتحصل عليها من هذه الدراسة بوضوح أن جميع الصفات المختبرة مثل صفات النمو الخضري (عدد الأفرع الخضرية/نبات، إرتفاع النبات وعدد أوراق /نبات)، التركيب الكيماوي للأوراق (محتوى كل من النيتروجين، والفوسفور، والبوتاسيوم، والبروتين بالمادة الجافة للأوراق و الكلورفيل الكلي بالأوراق الطازجة)، الصفات الزهرية (العدد والطول والوزن الطازج للنورات الزهرية للنباتات/كورمة، عدد الأزهار/نبات وعدد الأيام من الزراعة حتى ظهور النورات الزهرية) ومحصول الكورمات ومكوناته (عدد الكورمات/نبات، وزن الكورمات الطازج/نبات، قطر الكورمات، عدد الكريمات/نبات ووزن الكريمات الطازج/نبات) قد تأثرت معنويا بكل من نوع ماء الري، ومعدلات التسميد بأسمدة النيتروجين والفوسفور والبوتاسيوم وتفاعلاتهم. ففيما يتعلق بتأثير ماء الري، أعطى الري بالماء الممغنط القيم القصوى لجميع الصفات سابقة الذكر، ما عدا صفات النمو الخضري وصفات عدد النورات ووزن النورات الطازج وقطر الكورمات، مقارنة بمعاملة الري بالماء الغير ممغنط. أما فيما يتعلق بتأثير معدلات أسمدة النيتروجين والفوسفور والبوتاسيوم، فإن معدل 125 كجم/فدان سجل قيم معنوية لجميع الصفات سابقة الذكر مقارنة بالمعدل 50 كجم/فدان. وفيما يتعلق بتأثير معاملات التفاعل، فإن معاملة التفاعل بين الماء الممغنط والتسميد بالمعدل 125 كجم/فدان ذات تأثيرات معنوية على جميع الصفات المدروسة سابقة الذكر مقارنة بمعاملة التفاعل بين الماء الغير ممغنط ومعدل التسميد 50 كجم/فدان. لذلك يمكن التوصية بري وتسميد نباتات الجلاديولس (صنف روز سوبريم) بالماء الممغنط ومعدل التسميد 125 كجم/فدان من أسمدة النيتروجين والفوسفور والبوتاسيوم المعدنية لتحقيق صفات عالية لكل من النمو والسلوك الحقلي للنباتات تحت ظروف بحثية مماثلة.