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THE EFFECT OF DILUTED FOLIAR FERTILIZER WITH MAGNETIC TREATED WATER IN VEGETABLE GROWTH CHARACTERISTICS AND PRODUCTIVITY OF TOMATO

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Abstract

The aim of this research is to detect ways for reducing the negatively effect of using large quantities of chemical fertilizers, to get a contamination-free environment. The experiment was conducted at station farm in technical institute, Northern Technical University, Mosul city, Iraq, in spring of 2018-2019 to study the effect of diluted foliar fertilizer (DFF) with magnetically treated water (MTW) at strength 4800 Gauss on morphological parameters of tomato plant such as (fresh weight, dry weight, dry matter percentage and total number of fruits), two kind of foliar fertilizer was used RNZ granular fertilizer, NPK 20-20-20 and NeuWeled®Series, NPK 20-20-20 the experiment was designed according to Completely Randomized Design (CRD) with thirty observations for each treatment, each experimental unit contain ten plants. The results indicated that the first treatment (spraying tomato plants with diluted foliar fertilizer (1) with MTW) gave the best value in the means of fresh weight (gm) and did not differ significantly from the treatment 3 (spraying tomato plants with diluted foliar fertilizer (2) with MTW) according to Duncan's test, while the treatment 3 record the highest mean value for dry weight (gm), dry matter percentage and total number of fruits which differ significantly from other treatments. Treatment 5 (Spraying tomato plants with ordinary water with out any additions) gave the lowest mean value for all studied parameters fresh weight, dry weight, dry matter percentage and total number of fruits.

Key words : magnetic treated water, foliar fertilizer, tomato.

Introduction

Tomato (*Lycopersicon esculentum*) is an economically important vegetable crop in Iraq and the world. The population increasing in the world has led to increased demand for food. Therefore, the interest in to increasing agricultural production led to an increase in the rates of chemical fertilizers use, especially the cultivation of vegetable crops which led to affected health and environment negatively (Jasim *et al*, 2014). There are many parameters related with soil properties that restrict the taking up nutrients from the soil by the plant such as pH, texture, temperature, high humidity, poor aeration, calcium carbonate, ion imbalance and organic matter content. (Reena *et al*, 2018; Keller, 2005). Many chemical and biochemical processes that occur in the soil can be affected by above mentioned Parameters such as: adsorption - desorption, oxidation - reduction, complexation-dissociation and precipitation - dissolution, which control the mobility and availability of nutrients in soil (He *et al*., 2005). So many researchers indicated that the soil application of nutrient is the ancient and most common but it is not the most effective method to provide essential nutrients to plant. Balanced nutrition from both macro and micronutrient is essential for enhancing productivity and quality of field crops so fertilizer play a crucial role of all crop production (Reena *et al*., 2018). An alternative method to skip the problems of soil application is foliar nutrition (Kolota and Osinska, 2001) which defined as the application of one or more nutrients, bio stimulates, plant hormones, pesticides other essential substances to leaves and steams of plants (Laane, 2018). The advantages of using foliar nutrition is to increase the absorption rate by leaf tissue, effective transition to developing sides in parts, Remove the resulting losses from fixation, leaching as well as increase the mineral content of the plant through effective utilization of nutrients

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Table 1: The composition of RNZ granular fertilizer.

Test	Specification
Total Nitrogen by weight	20% min
Nitrate Nitrogen by weight	4.9% max
Ammoniacal Nitrogen by weight	3%min
Urea Nitrogen by weight	12.1% max
Water soluble phosphate (as P_2O_5) by weight	20%min
Water soluble potash (K2O) by weight	20%min
Sodium as NaCl percent by weight	0.06%max
Matter insoluble in water by weight	0.5% max

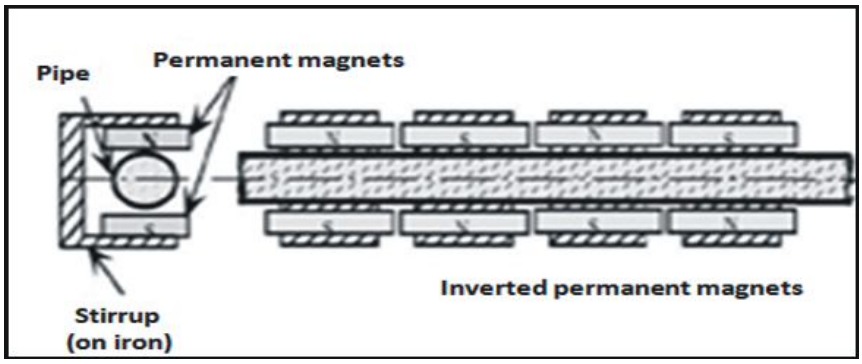

Fig. 1: Scheme of the magnetically treated water device with alternated polar pieces.

and then the quality and quantity of yield (Reena *et al.*, 2018). Reduce the damage of many stress such as frost, heat and drought (Alshaal and El-Ramady, 2017). To reduce the amount of mineral fertilizer and total water used for irrigation many modern studies reported that the using of magnetically treated water (MTW) for plant irrigation improve the quantitative and qualitative of crop production (Abou El-Yazied *et al.*, 2012; Maheshwari and Grewal, 2009) Magnetically treated water (MTW) is that water which passed through electromagnetic or through permanent magnets before to use (Shahin *et al.*, 2016) magnetized technology affected in different prosperities of plant such as seed and seedling growth, chlorophyll quantities, protein biosynthesis, enzyme activities, mRNA quality and gene expression (Moussa, 2011; Atak, 2003). So it represented as one of the important friendly environmental techniques (Abou El-Yazied *et al.*, 2012).

In this study we tried to investigate the expected effect of diluted foliar fertilizer with magnetic treated water in vegetable characters growth and yield of tomato crop.

Material and Methods

The experiment was conducted at station farm in technical institute, Northern Technical University, Mosul city /Iraq, in spring of 2018-2019 to study the effect of diluted foliar fertilizer (DFF) with magnetically treated water (MTW) at strength 4800 Gauss on morphological parameters of tomato plant such as (fresh weight, dry weight, dry matter percentage and total number of fruits).

Table 2: The composition of Neu Weled fertilizer.

Test	Specification
Total Nitrogen	20%
Urea Nitrogen(NH2-N)	15.5%
Ammoniacal Nitrogen(NH4-N)	3%
Nitrate Nitrogen(NO3-N)	1.5%
Water soluble phosphate (as P_2O_5)	20%
Water soluble potash (K2O)	20%
B	0.01%
CU	0.01%
Fe	0.02%
Mn	0.01%
Zn	0.02%

Foliar fertilizer dilution

In this experiment two kind of foliar fertilizer was used RNZ granular fertilizer, NPK 20-20-20 and NeuWeled®Series, NPK 20-20-20 which diluted with MTW according to manufacturer s instructions 4g/L.

Design of Magnetically Treated Water Device (MTD)

The water which used in this experiment was treated by using MTD which designed according to (Abou El-Yazied *et al*, 2012; Gabrielli) 4 pairs of magnets about 4800 Gauss used in made up the device which arranged in an alternating arrangement, the north and south poles facing each other fig. 1. The water treated by passing through a pipe put between the polar pieces Which are polar opposites.

Experiment procedure

Initially tomato seeds planted in pots when the seedlings reached 5cm in length transplanted in the experimental field, Plants were spaced at 0.3 m in paired with 0.5 m between row to rows the treatments include:

- Spraying with foliar fertilizer (1) diluted with MTW (MDFF1).
- Spraying with foliar fertilizer (1) diluted with ordinary water (OW) (ODFF1).
- Spraying with foliar fertilizer (2) diluted with MTW (MDFF2).
- Spraying with foliar fertilizer (2) diluted with OW(ODFF2).

Table 1: Analysis of Variance for the effect of treatments on studied parameters.

Sources of variation	Degrees of freedom	Mean squares (M.S.)			
		Fresh weight	Dry weight	Dry matter percentage	No. fruits Total
Treatments	5	3334943.61**	479065.044**	615.818186*	87738.8667**
Error	174	42120.55	67767.72	266.32089	1330.7464
Total	179				
* , ** significant at 0.05 and 0.01 respectively.					

- Spraying with OW with out any additions (OW).
- Spraying with MTW with out any additions (MTW).

The first spray applied when seedlings reached 10 cm in length while the second spray applied after two weeks from the 1st one, finally the third spray applied after month from the 2nd one. ordinary water was used in irrigation and no fertilizer was added to the soil.

After three months thirty samples for each treatment were taken to determine the following parameters (fresh weight (gm), dry weight (gm), total number of fruits and dray matter percentage which calculated as follows :

$$\text{Dry matter percentage} = \frac{\text{Dry weight}}{\text{Fresh weight}} \times 100$$

Experimental design

The six treatments of sprayed fertilizers diluted with water was designed according to Completely Randomized Design (CRD) with thirty observations for each treatment, each experimental unit contain ten plants, at the end of experiment data collected for studied characters and analyzed using SAS program and Duncan multiple range test used to detect the significant difference between treatments (SAS, 2002)

Results and Discussion

The data in table 1, indicate to analysis of variance for the effect of treatments on tomato plant characters, Where the effect of the treatments which used in the experiment was significant at 1% level for the parameters of fresh weight, dry weight and total No. fruits and it was significant at 5% for dry matter percentage parameter.

The data in table 2, indicate to means of treatments effect on studied growth parameters, Where the first treatment spraying tomato plants with diluted foliar fertilizer (1) with MTW (MDFF1) gave the best value in the means of fresh weight (gm) and did not differ significantly from the treatment 3 according to Duncan's test, while the treatment 3 spraying tomato plants with diluted foliar fertilizer (2) with MTW record the highest mean value for dry weight, dry matter percentage and total number of fruits which differ significantly from other treatments With the exception of the number of fruits parameter where there was no significant difference between the third and first treatment, treatment 5 gave the lowest mean value for all studied parameters fresh weight, dry weight, dry matter percentage and total number of fruits and significantly differ from other treatments in fresh weight character, while in dry weight character coupled with treatment 4 and 6, in dry mater percentage there is no differ significant with other treatments expiation the highest value in treatment 3 and finally in number of fruits parameter coupled with treatment 6 and didn't differ significantly. The superiority of the treatments which spray with foliar fertilizer diluted with MTW may due to the magnetically treated water has a higher solubility compared to ordinary water, dissolves minerals and salts and increases their abundance (Al-Naqeeb *et al.*, 2008). The technology of magnetic water improves the quality of water like pH, solubility of salts, surface tension and conductivity (Grewal and Maheshwari, 2011) magnetic field affect the structures of cell membranes and increases their permeability and ion transport through the ion channels, which influence different metabolic pathway activities (Balouchi and Sanavy, 2009).

(Stange *et al.*, 2002) reported that the electromagnetic

Table 2: Means of treatments effect on studied growth parameters.

S. No.	Treatments	Fresh weight (gm)	Dry weight (gm)	Dry matter percentage	Total No. fruits
1	Foliar fertilizer(1)+MTW(MDFF1)	2048.96 A	445.77 B	21.817 B	181.067 A
2	Foliar fertilizer(1)+ OW (ODFF1)	1899 BC	396.7 CB	20.908 B	155.2 B
3	Foliar fertilizer(2)+MTW(MDFF2)	1966.33 AB	579.38 A	30.81 A	183.767 A
4	Foliar fertilizer(2)+OW(ODFF2)	1802.83 C	352.86 CBD	19.606 B	134.633 C
5	OW with out additions (OW)	1211.36 E	226.37 D	18.689 B	62.433 D
6	MTW with out additions (MTW)	1420.89 D	274.39 CD	19.313 B	67.5 D
-The means followed with the same letters have no significant difference at 0.05% level.					

fields change the lipid protein dynamics in the structure of cell membrane which probably result in modification the permeability of the plasma membrane of plant cell. (Taia *et al.*, 2007) reported that the reason behind the increased water absorption due to the variations stimulate through magnetic fields in the ionic flow across the cellular membrane which result in change the osmotic pressure. Magnetic water technology improve water quality such as Ph, surface tension, solubility of salts, conductivity (Grewal and Maheshwari, 2011).

(Faten *et al.*, 2009) and (Maheshwari and Grewal, 2009) clear the action of magnetic field in improvement growth and crop yield by activation of the bio-enzyme systems and phyto-hormone such as indole-3-acetic acid.

These results are agree with those reported by (Jawad *et al.*, 2014) they indicated there are high percentage in tomato fruits size and intensity by using MTW at strength 4800 G in irrigation and fertilization with NPK at 50% concentration. (Abou-El-Yazied *et al.*, 2012) found that the plant height and fresh weight were increased in plants grown with magnetic treatment (seeds or irrigation) compared with those with out magnetically treated. (Moussa, 2011) reported that the irrigation with MTW increased the growth characters of common bean as well as photosynthesis pigments (chlorophyll a, chlorophyll b and carotenoid), potassium translocation efficiency. (Yusuf and Ogunlela, 2015) indicated that the MTW effect the vegetative growth of tomato with increasing the growth rate and decreasing the maturity time and rise the yield.

The treatment 3 the use of foliar fertilizer (2) diluted with MTW (MDFF(2)) in spraying tomato plants gave significant value in the characters of dry weight, dry matter percentage and total No. fruits while the treatment 1 the use of foliar fertilizer (1) diluted with MTW (MDFF1) record the highest value of fresh weight.

Recommendation

The use of foliar fertilizer (2) diluted with MTW at strength 4800 G (MDFF2) can have effects of the characteristics of tomato plant.

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