Plant Archives Volume 20 No. 1, 2020 pp. 533-536 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

THE EFFECT OF MAGNETICALLY TREATED WATER AGAINST *FUSARIUM* WILT DISEASE IN TOMATO CAUSED BY THE FUNGUS *FUSARIUM OXYSPORUM* AND ITS EFFECT ON PRODUCTION UNDER FERTILIZED FARMING CONDITIONS

Mena W. Hatem[1], Hussein M.Shukri[2], Khalid A. Rasheed[3], Majeed H. Nawar[1], Salah M. Hasan[3] and Rawaa Adnan[3]

[1]College of Agricultural Engineering Sciences, University of Baghdad, Iraq.
[2]College of Biotechnology, Al-Nahrain University, Iraq.
[3]Biotechnology Research Center, Al-Nahrain University, Iraq.

Abstract

A biological experiment was conducted to study the effect of magnetized water to control *fusarium* wilt disease in the tomato caused by the fungus *Fusarium oxysporum* and its effect on tomato production under the conditions of fertilized and protected agriculture. For this purpose, magnetic fields with 0, 1000, 1500, 2000, 2500 and 3000 Guass, were used for biological control of pathogenic fungi on two types of local and foreign tomatoes. All the experiments were designed according to Complete Random Design.

The seeds of the tomato were planted in a 10 kg bag of mixed soil with pittmoss with ratio 1:1. The effect of magnetized water on the severity of disease was measured using pathological evidence and growth parameters, plant height, number of branches, length of the leaf and production.

Field results (under protected conditions) showed significant differences at $p<0.05$ between the magnetic water and the control. The diameter of the fungus colonies decreased in the petri dishes with different magnetic water fields, until the inhibitory rate of fungal growth was 100% when using magnetized water to 3000 Gauss. The incidence of fungal infection after 40 days decreased by increasing the magnetized water. The intensity of the fungal infection decreased to 15.3% in foreign type and the local up to 22.5% at the magnetic intensity of 3000 Gauss compared to the control treatment with infection of 80.2% and 90.6%, respectively. While, the increasing levels of growth and production by increasing the magnetic field of irrigation water. Where the plant height was 40.3cm for the foreign type and 33.5cm for the local type at a magnification intensity of 3000 Gauss, compared to the control treatment, where the plants were 19.2cm high and 18.9cm respectively. As well as the number of branches and the length of the leaf plant. The production of the fruit of the Tomato for one jar was about 3.83 kg of the Foton and 2.70 kg of the local type of the water with a magnetic field of 3000 Gauss compared to control plants foton 2.13 kg and local type 1.20 kg .

***Key words**:* Magnetic water, *Fusarium* wilt disease, tomato

Introduction

The *Lycopersicon esculentum* is one of the most important vegetable crops grown in the world, including Iraq, for its high nutritional value and economic importance. It belongs to the Solanaceae family of 90 genera and 2000 species with high nutritional value. Each 100 grams contains 23 mg of vitamin C and 900 IU of vitamin A and 0.06 mg of vitamin B1 and 4.7 g of carbohydrates per 100 g (Hassan *et al*., 2011).

Tomato plants are exposed to a variety of important diseases, including Soil-Born pathogen, which is considered one of the most dangerous pathogens because it is found in a soil environment that contains many organisms that have interconnected relations with the environment surrounding them (Garrett, 1970). One of the diseases that affect the tomato is *Fusarium* wilt

***Author for correspondence :** E-mail: majeedhameedn@gmail.com, shukrihussein3@gmail.com, k_rasheed29@yahoo.com

caused by *Fusarium oxysporum.*

In order to control this disease, different resistance methods were utilized, primarily chemical pesticides, but extensive use led to the emergence of resistant strains and the health and environmental risks resulting from them (Taylor *et al*., 2002). Some studies have shown the success of induction of systemic resistance against a large number of plant pathogens by stimulating the host's self-defense by a biologist and a biotic factor (Vanloon Bakker, 2003). In recent years, magnetic technology has been used in applied fields in many countries of the world and has been commonly used in various fields of life (Szkatula *et al*., 2002) and in improving water properties and sterilization (Starmer, 1996).

Magnetic technology was also used for medical and health purposes (Nasser, 2006). Some recent studies have a tendency to employ this technique for the purpose of treating and improving some soil properties (Al-Juzari, 2006), improving plant growth and increasing productivity (Al-Jubouri, 2011, Shukri, 2013). The magnetic technology in the control of the bushes was also used to increase the efficiency of the Trifloralin herbicide and its effect on the growth properties and cotton yield (Fartousi, 2011). Magnetized water was used to protect cucumber plant from the fungus *Pythium aphanidermatum* in combination with Salicylic acid (Khazraji, 2007).

The aim of the present research is to use magnetized water in the control of fungus *Fusarium oxysporum* and increase the growth and production of tomato plant.

Materials and Methods

1. Isolation and Diagnosis: *Fusarium oxysporum* was isolated in infected tomato plants showing symptoms of yellowing and wetting in the Abu Ghraib-Baghdad farms. The infected parts were sterilized with sodium hypochlorite solution (1% chlorine) for three minutes after being washed with running water and then cut off (0.5 cm), washed with distilled water and then dried with sterile detergent paper and transferred to Petre dish contained Potato sucrose Agar (PSA) dishes. The dishes were neutralized for three days at a temperature of 25°C and then examined for the detection of fungi based on the keys (Booth, 1971; Domschi *et al*., 1980). The pathogenesis of known isolates of pathogenic fungi using tomato seeds were tested in the environment of acorn, sucrose and potatoes.

2. Test of pathogenicity of isolation fungi pathogen by using tomato seeds in from the PSA media.

3. Effect of magnetized water on the growth of pathogenicity fungi from the PSA media.

A sterile 9 cm diameter plastic petri dish containing PSA and a 0.5 cm diameter tablet was used in the middle of the petri dish taken near the edge of the 3-day *Fusarium oxysporum* colony, adding 1 ml of sterile magnetized water of (1000, 1500, 2000, 2500 and 3000) Guass, with 3 replicates for each magnetic intensity used. The control treatment was added to 1 ml sterile distilled water, incubated at 25°C for a period of three days and the final results were calculated by measuring the two diagonal diameter of the country colony, then the percentage of inhibition was calculated according to the following equation:

$$\%\ inhibition = \frac{average\ control\ diameter - average\ treatment\ diameter}{average\ control\ diameter} \times 100$$

Agriculture in the plastic house

The study was conducted during winter 2015 using mixed soil mixed with pitmos 1: 1 in 10kg plastic container in a plastic house at the Biotechnology Research Center /Al-Nahrain University. The magnetic technique was used in different intensities with the use of magnets in the following intensity in the growth of two types of tomatoes (local - foreign). The experiment was designed according to Complete Random Design sectors with three replicates. The first factor included the local and foreign tomato varieties. The second factor is magnetized water in different ways as follows

1. Fungus + natural water (control)
2. Fungus + magnetized water of 1000 Gauss
3. Fungus + magnetized water of 1500 Gauss
4. Fungus + magnetized water of 2000 Gauss
5. Fungus + magnetized water of 2500 Gauss
6. Fungus + magnetized water of 3000 Gauss

Tomato seeds were cultured for both local and foreign varieties in polystyrene dishes with one seed per square. The fungus was cultured on millet grains. It took 100 g of grains and placed in a glass flask with a capacity of 500 ml and was sterilized twice (121°C and 1.5 kg/cm^2 for 60 minutes). Each flask was vaccinated with three tablets from the 7 days. The flasks were incubated for 15 days at 25°C, taking into account the vials to stimulate growth and good mixing every two days to ensure homogeneity of the distribution of mushrooms in the center.

The experimental design for testing the effect of magnetized water against vascular wilt disease was carried out in 5 kg plastic containers in sterile mixture twice at 121°C and 1.5 kg/cm^2 for 60 minutes. The fungus *Fusarium oxysporum*, which was grown on millet seed, was added to the soil by 1% (weight/weight) and

Table 1: Effect of magnetized water on colony diameter and percentage of inhibition in fungus.

Magnetized waterGauss	Average colony diameter cm/after 3 days	Inhibition %
Control	9.00	0.00
1000	7.22	19.78
1500	6.11	32.11
2000	5.22	42.11
2500	2.33	74.11
3000	0.00	100

incubated in the plastic house. The fungus *fusarium oxysporum*, which was grown on millet seed, was added to the soil by 1% (weight / weight) and was placed in the plastic house. As for the treatment of control, sterile and fungus-free millet seeds were added to the soil, the soil was cleaned and packed with three-day polyethylene bags to ensure penetration of soil pathogenic fungi. The seedlings were then transferred to the 10kg extract at the age of one month, according to the Complete Random Design sectors for three replicates per treatment, with five seedlings per pot.

Some parameters of growth were measured, such as plant height, number of branches and length of plant leaves and the severity of the infection was calculated after forty days of planting the seedlings in the tomato according to the Mekinney equation (1923). The severity of the disease was calculated using the five-point disease index as follows:

0. healthy plant
1. Yellow (1-25)% of the leaves
2. yellowing and wilting (26-50)% of the leaves
3. yellowing and wilting (51-75) % of the leaves
4. Wilt and death (76-100)% of the leaves

Results and Discussion

Table 1, shows the effect of magnetized water intensity on colony diameter and percentage of inhibition of fungi, as the diameter of the colony reduced by increasing the magnetic intensity of the water used. The colony diameter was 9 cm in the control treatment (using non-magnetized water) and the colony diameter began to decrease at the third day with increasing magnification of the water to completely eliminate the fungus, when the magnetic intensity is 3000 Gauss. These results have been agreed with Al-Khazraji, (2007), who has decreased the incidence of fungus *Pythium aphanidermatum*, when using magnetized water in the growth and protection of cucumber from fungal infection.

Table 3: Effect of magnetized water in the productivity of tomato.

Treatments	Productivity kg/s	
	Foreign	local
Fungus+natural water	2.13	1.20
Fungus+1000G	2.33	1.46
Fungus+1500G	2.63	1.80
Fungus+2000G	3.03	2.13
Fungus+2500G	3.33	2.43
Fungus+3000G	3.83	2.70

The results showed a decrease in the intensity of fungal infection with increased magnetic intensity compared with control treatment and was significant ($p<0.05$).

Table 2, indicates the increase in the height of the plant, the number of branches and the length of the leaves as the intensity of the magnetization of irrigation water increases compared to the control treatment.

The results of table 3, show that all the irrigated water with a high intensity of 3000 gauss for the foreign cultivar resulted in a significant increase in the weight of the fruit (kg/s), which gave the highest production rate (3.83 kg/pot). The effect of magnetized water on the local type with the same intensity (3000 gauss) gave productivity of (2.70 kg/s). In this experiment, we observe the superiority of the foreign cultivar on the local type in the irrigated productivity.

These results may be due to the role of magnetized water in increasing the availability of water and nutrients in the soil, increasing its uptake by the plant and the presence of a distinct mechanism of magnetization to improve the physical and chemical properties of water, soil and vegetation (Gosselin, 2004). And thus increase the process of photosynthesis in the plant and the use of carbohydrates and nutrient balance and increase in transpiration rates and overall growth of the plant, which includes the growth and expansion of cells and the manufacture of biomass and thus an increase in the number of fruits.

Table 2: Effect of magnetized water in the severity of fungal infection.

Treatments	Severity of fungus		Plant hight		No. of branches		Length of leaves	
	Foreign	Local	Foreign	Local	Foreign	Local	Foreign	Local
Fungus+natural water	80.2	90.6	19.2	15.9	2.2	1.9	8.5	7.5
Fungus+1000G	65.3	72.5	25.5	23.7	3.2	2.7	8.8	7.9
Fungus+1500G	55.5	60.4	26.5	25.5	3.6	2.9	9.0	8.1
Fungus+2000G	46.4	64.7	35.2	27.3	4.6	3.8	10.0	8.9
Fungus+2500G	40	45.5	38.0	30.1	5.5	4.3	11.3	9.5
Fungus+3000G	15.3	22.5	40.3	33.5	7.5	5.3	12.5	10.3

Takashinko, (1997) proved that the magnetized water can be reduced the negative effects of salts and improving the kinetic properties of water into plant cells and in the readiness of plant elements, including phosphorus, which helps to form a large radical mass that helps absorb the nutrients needed to develop and increase the weight of fruits, then the products of photosynthesis increase and the amount of materials transferred to the fruits increases, resulting in increased weight.

References

Al-Jaboury, A.J. Moheisen, Ashwaq Sh. Abdul, Khalid A. Rasheed, Duha M. Majeed, Salah M. Hassan and Iman N. Ismail (2011). The effect of magnetization of saline irrigation water on the germination and growth of wheat bread crops *Triticum aestivium* L. *J. of Biotechnology Res.Center.*, **5(3)**.

Al-Jawthari, H.Y. Attia (2006). Water Quality Effects, Magnetism and Potassium Water Levels in Some Chemical Soil Properties and Growth of Maize Extract, Ms.C. Thesis. Soil and Water Section. Faculty of Agriculture. University of Baghdad. 135.

Al-Khazraji, Y. Edan (2007). The effect of magnetized water and salicylic acid on the growth and protection of plant cucumber from the infection of fungus *Pythium aphanidermatum*. PhD. Thesis, Department of Plant Protection. Faculty of Agriculture, Baghdad University.

Al-Fartoussi, H. Ab. Khashan (2011). The technique of using magnetized water in the efficiency of the Trifloralin pesticide to control the bush and its effect on cotton growth and yield characteristics. PhD Thesis. *Department of Science in Field Crops*. Baghdad University.

Al-Kaabi, M.J. Mohammed (2006). The effect of using magnetized water in irrigating the workshops of urea, iron and zinc in the growth of local orange seedlings. Ms.C. Thesis. *Department of Horticulture. Faculty of Agriculture*, Baghdad University. 101.

Booth, C. (1971). The genus *Fusarium*. Common wealth mycological. instiut, Kew, Surrey, England, 58.

Domasch, K.H.W. Gams and T. Anderson (1980). Compendium of soil fungi. vol. I Academaic press. Asubsidiary of Harcourt Brace - Jovanovich, pub. 323.

Garrett, S.D. (1970). Pathogenic root infecting fungi. Cambridge Univ. Press. 294.

Gosselin and M.J. Erudel (2004). Interaction between roots temperature and Com. *J. Plant Sci.*, **56:** 185-192.

Hassan, A. Qasim, Azzam H. Khalaf and Ali Sh. Fares (2011). Effect of magnetization of saline irrigation water in different intensities in the growth and yield of two cultured cultivars in desert areas inside greenhouses. *Journal of the Center for Biotechnology Research.*, **5(3):** 66-72.

Matloob, A. Nasser, S. Ezzedine and Abdool S. Kareem (1981). Vegetable production, Part II. Dar Al Kutub For Printing & Publishing. University of Mosul. 46.

Mckinneg, H.H. (1923). Influence of soil Temp. & Moisture of infection of wheat seedling by *Helminthosporium sativum*. *J. Agric. Res.*, **26:** 156 -217.

Nasser, A. Abdel-Majid (2006). Effect of magnetized water on some performance in mice. Ms.C. Thesis. Institute of Genetic Engineering and Biotechnologies for Postgraduate Studies. Baghdad University.

Shukri, H. Mahmoud (2013). The interaction between irrigation with magnetized water and fertilization was influenced by the growth of *Salvia officinalis* and the concentration of the active substance (Thujone). *International Journal of Science and Technology.*, **8(3):** 69-78.

Szkatula, A.M-Balanda and K. Kopeck (2002). Magnetic treatment of industrial silica activation. *Eur. Phys. J.*, **18:** 41-49 (Abstract).

Starmer, J.E. (1996). Magnetic treatment of swim pool water for enhanced chemical oxidation and disinfecting. M.Sc. Thesis. *Grandfiled Univ. School of Water Sciences*. (Abstract).

Taylor, R.J.B. Salas, G.A. Secor, V. Rivera and N.C. Gudmestod (2002). Sensitivity of North American isolates of Phytophthora Erythrosertica & *Pythium ultimum* to Mefenoxan (Metalaxyl). *Plant Disease.*, **86:** 797.

Takashinko, Y. (1997). Hydro magnetic system and their role in creating micro climate International symposium on sustainable management of sall. Affect soil, Cairo, Egypt, 22-28. sept.

Valoon, L.C and P.A.H. Bakker (2003). Signaline in rhizobacteria-plant interaction. *Ecology studies.*, **168:** 297-330