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Effects of Deficit Irrigation on the Growth and Yield of Tomato (*Solanum lycopersicum*) Irrigated with Magnetised Water

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This study was conducted to determine the effect of deficit irrigation on the vegetative growth and the yield of tomatoes (*Solanum lycopersicum*) irrigated with magnetic water. A magnetic field was produced by an electromagnet. The value of magnetic flux density used for treating the irrigation water was 719G. Tomato plants (variety UC82B) were transplanted into 16 buckets (1 tomato stand per bucket) after 26 days at the nursery stage. The tomato plants were grown in a transparent garden shed for another 94 days and irrigated with magnetised water (magnetically treated water). A control experiment was also set up with 16 buckets (1 tomato stand per bucket), irrigated with non-magnetised water. The treatments for this study were 100%, 80%, 60% and 50% of water requirement (1.3 litres at 100%) by tomato plants, and the four treatments were labelled as T_1, T_2, T_3 and T_4, respectively. The heights of tomato plants with magnetised water after 50 days were 628.8 mm, 630.0 mm, 600.0 mm, and 562.6 mm, respectively, and the yields after 130 days were 587.8 g, 441.9 g, 410.7 g and 312.4 g per tomato stand (g per bucket), respectively. The heights of tomato plants with non-magnetised water were 601.3 mm, 578.8 mm, 557.5 mm and 447.5 mm, respectively, and the yield for T_1, T_2, T_3 and T_4 were 439.9 g, 379.5 g, 374.6 g and 236.6 g per tomato stand per bucket, respectively. The increment in the yield with magnetised water varied from 9.64 to 33.62% compared with the yield from non-magnetised water and the effect of magnetic water on the tomato yield was statistically significant.

Keywords: deficit irrigation, magnetised water, tomato.

Introduction

Irrigation is important for crop production during the dry season and needed during the rainy season to supplement rain that is usually erratic in some countries like Nigeria for adequate food supply. Inadequate availability of water for irrigation during the dry season to meet water requirement of crops usually hinders crop production in Nigeria. Deficit irrigation is a partial supply of water to crop in which irrigation water does not provide the total water requirement by the crop especially during the vegetative growth to reduce the cost of water for irrigation. Deficit irrigation is usually practiced in the areas where water is scarce, but total water requirement by the crop (full irrigation) should be supplied at the flowering stage to prevent the effect of water shortage on crop yield. Anand et al. (2012) indicated that magnetic treatment of irrigation water could alleviate an adverse effect of water stress (water shortage) in crop because it reduces production of free radicals and activity of antioxidant enzymes. Magnetic treatment of water is a new technology and a non-chemical method for crop improvement although the technology is not common in most developing countries, and especially Nigeria. It is an environmentally friendly method for a high crop yield which does not cause soil degradation by salinity and does not pollute the environment. Magnetic treatment of water (magnetised water) boosts the crop yield, improves crop quality and enhances effective utilisation of the arable land using the available water sources for crop production (Babu, 2010, Dhawi, 2014, Hozayn and Abdul-Qados, 2010, Maheshwari and Grewal, 2009, Selim, 2008, Suchitra and Babu, 2011, El-Sayed and Sayed, 2014). The magnetic field can only have an effect on water when water flows across the magnetic field and the flow of water is at right angle to the magnetic field. Magnetic treatment of water reduces surface tension of water, increases mineral dissolvability of water and provides adequate nutrients for plant growth (Babu, 2010).

Moussa (2011) indicated that magnetically treated water (magnetised water) that was treated with 300 G improved quantity and quality of common bean crop. Moussa (2011) stressed further that magnetic water could stimulate the defence system, photosynthetic activity, and translocation efficiency of photoassimilates in common bean plants. Noran et al. (1996) also pointed out that the results of their work confirmed the effect of the magnetic field on solutes, and the interaction between soil particles and salts dissolved in ordinary water is not the same as the interaction between soil particles and salts dissolved in magnetically treated water.

Muraji et al. (1992) also showed that there was an enhancement in root growth of maize (***Zea mays***) by exposing the maize seedling to 50 G magnetic fields at alternating frequencies of 40–160 Hz. However, there was a reduction in the primary root growth of maize plants grown in a magnetic field alternating at 240–320 Hz. Magnetic fields can also influence the root growth of various plant species (Muraji et al., 1992). Magnetic fields can also influence the root growth of various plant species (Muraji et al., 1992). Kochmarsky (1996) indicated that the effective magnetic induction for water treatment ranged from 1,000 to 6,000 G. Kochmarsky (1996) also pointed out that 4,000 to 5,000 G could attain the efficiency of 60% to 80% when applied on heater and low–pressure boilers. Maheshwari and Grewal (2009) monitored and recorded the magnetic flux densities inside the treatment pipe where the actual treatment occurs and the values of magnetic field strength obtained ranged from 35 to 1,360 G.

The objectives of this study were 1) to determine the effect of deficit irrigation (water stress) on the vegetative growth of tomato plants irrigated by magnetised water; and 2) to determine the effect of deficit irrigation on the yield of tomatoes irrigated by magnetised water.

Materials and Methods

The study was carried out in the Department of Agricultural and Biosystems Engineering, University of Ilorin, Ilorin, Kwara State, Nigeria. Ilorin lies on the latitude 8°30[1]N and longitude 4°35[1]E at an elevation of about 340 m above the mean sea level (Ejieji and Adeniran, 2009). Ilorin is in the Southern Guinea Savannah Ecological zone of Nigeria with annual rainfall of about 1,300 mm. The wet season begins towards the end of March and ends in October while the dry season starts in November and ends in March (Ogunlela, 2001). The temperatures from the wet and dry bulb thermometer in the transparent garden shed where the tomato plants were grown between 23 September 2014 and 30 January 2015 varied from 16.5°C to 30.0°C (wet bulb) and 23.5°C to 38.0°C (dry bulb) with relative humidity of 50% to 90%.

The mean value of magnetic flux density used in this study was 719 G (0.0719 T) inside the treatment pipe produced from an electromagnet. The value of magnetic flux density corresponding to 719 G between two magnetic cores without air gap was 4,310 G. The tomato plants (variety UC82B) were firstly planted in two buckets at the nursery stage; one bucket was irrigated with magnetised water, while the other bucket was irrigated with non-magnetised water. The tomato plants were transplanted into 16 buckets (1 tomato stand per bucket) after 26 days at the nursery stage. They were grown in a transparent garden shed for another 94 days and irrigated with magnetised water (magnetically treated water). A control experiment was also set up with 16 buckets (1 tomato stand per bucket) irrigated with non-magnetised water. The treatments for this study were 100%, 80%, 60% and 50% of water requirement (with 1.3 litres at 100%) by the tomato plants, and the four treatments were labelled T_1, T_2, T_3 and T_4, and each treatment was replicated four times in the transparent garden shed. A control experiment was also set up in the garden shed and CRD experimental layout was used with 16 buckets for each set up. The soil used in this study was loamy sand with percentage contents of silt, clay and sand 8.67%, 5.76% and 85.57%, respectively. The chemical property of the soil used is shown in Table 1.

The north and south poles of the electromagnetic cores on the treatment pipe seat in this study were alternated for effective treatment of irrigation water by the magnetic field (McMahon, 2009). The irrigation water was allowed to pass through the treatment pipe four (4) times for duration of 113 s. The circulation flowing method through the electromagnet shown in Plate1 was used for effective treatment as stated by Chern (2012). The growth (height), stem thickness (diameter) and yield of the tomato plants during the vegetative growth were monitored and recorded.

Table 1

Chemical properties of the soil used

Element	Sample A	Sample B	Sample C	Mean
1	2	3	4	5
pH	6.0	5.8	5.6	5.8
N (%)	0.58	0.63	0.71	0.64
P (mg/kg)	2.51	2.46	3.25	2.74
Ca^{2+} (cmol/kg)	1.28	1.14	1.68	1.37
Mg^{2+} (cmol/kg)	0.92	0.58	1.01	0.84
K^{+} (cmol/kg)	2.20	2.11	2.42	2.24
Na^{+} (cmol/kg)	1.03	1.24	1.18	1.15
Organic matter (%)	1.56	1.15	1.22	1.31
Organic carbon (%)	0.90	0.67	1.01	0.86
C.E.C (meq/100g of soil)	5.63	5.12	6.46	5.74

Determination of water requirement by the tomato and irrigation interval

Water requirement of tomato plants is the amount of water required to meet the required evapotranspiration, photosynthesis and metabolic processes. Crop evapotranspiration, depth of water required to bring the soil to field capacity at the beginning of the experiment, available water, wilting point, net depth of irrigation, irrigation interval, volume of water required daily by tomato plants and volume required in a 3-day irrigation interval for two stands of the tomato plant were determined using Equations (1), (2), (3), (4), (5), (6) and (7) respectively.

$$ETc = K_c \times ET_o \tag{1}$$

$$D_F = \frac{\rho_b}{\rho_w}\left(\frac{FC - \Theta_1}{100}\right)D_b \tag{2}$$

$$AW = \frac{\rho_b}{\rho_w}\left(\frac{FC - WP}{100}\right)D_b \tag{3}$$

$$WP = \frac{FC}{F} \tag{4}$$

$$I_v = \frac{d_n}{ETc} \tag{5}$$

$$V_{dp} = K_c \times ET_o \times C_c \times A_p \tag{6}$$

$$V_{days} = V_{dp} \times N_p \times I_v \tag{7}$$

where

ET_c is the crop evapotranspiration (mm/day), K_c is the crop coefficient, ET_o is the reference evapotranspiration (mm/day), D_F is the depth required to bring moisture content to field capacity at the beginning of the experiment (mm), ρ_b is soil bulk density (g/cm^3), ρ_w is the density of water (g/cm^3), FC is the field capacity of the soil (%), θ is the moisture content of the soil prior to irrigation (%), D_b is depth of the bucket (mm), Aw is the available water (mm), WP is the wilting point (%), F is a factor ranging from 2.0–2.4 depending on the percentage of silt in the soil. The value of F used was 2.2 and the wilting point was calculated to be 12.26% when field capacity (FC) was 26.98%. A 1.30 litres of water was determined as the water required by two stands of the tomato plant for a 3-day irrigation interval.

Statistical analysis for the yield of tomato by paired t test

The paired t test was done to find out if the yield of tomatoes produced by magnetically treated water (MTW) was statistically significant or not when compared with the yield of tomatoes produced by non-magnetically treated water (NMTW). The difference between the two mean yields of the tomatoes irrigated by MTW and NMTW was determined and then used to compute standard deviation, standard error and the t test value using Equations (8), (9a) or (9b), (10) and (11), respectively, as given by Montgomery et al. (1998).

$$\bar{d} = \frac{\sum d}{n} \tag{8}$$

$$\delta = \sqrt{\frac{\sum\left(d - \bar{d}\right)^2}{n-1}} \tag{9a}$$

$$\delta = \sqrt{\frac{\sum d^2 - n\left(\bar{d}\right)^2}{n-1}} \tag{9b}$$

$$\delta_{Er} = \frac{\delta}{\sqrt{n}} \tag{10}$$

$$t_{cal} = \frac{\overline{d}}{\delta_{Er}} \tag{11}$$

where

$\overline{d}$ is the mean of the difference from the data x_1 and x_2, Σd is the summation of d, n is the number of the observations, δ is the standard deviation, δ_{Er} is the standard error and t_{cal} is the calculated value of t which was compared with the Table value (t_{Tab}) of obtained from Montgomery et al. (1998).

Results and Discussion

Vegetative growth and stem diameter

The results of this study revealed that using magnetic flux density of 719 G for treating irrigation water has an effect on the vegetative growth and the stem thickness of tomato plants. Tomato plants which were irrigated with magnetically treated water grew faster and had a bigger stem diameter than those irrigated with non-magnetically treated water (NMTW) as shown in Tables 2 and 3. Tomato plants irrigated with magnetically treated water also matured faster and the first harvest occurred on day 77 after planting but harvesting started day 85 after planting with non-magnetised water. Reduction in time of maturity (early maturity by about two weeks) of plants irrigated with magnetically treated water was in agreement with the research conducted by Maheshwari and Grewal (2009) and Sellim (2008). The pictures of tomato plants 40 days after planting irrigated with MTW and NMTW are shown in Figures 1 and 2. The growth of tomato plants irrigated with MTW under deficit irrigation (water stress) was not statistically significant when the calculated value of F was 2.44 while the Table value was 3.49 at a 5% significance level, as shown in Table 4. The growth rate (height) of tomato plants irrigated with NMTW under water stress was statistically significant when the calculated value of F was 8.97, but the Table value of F was still 3.49 at a 5% significance level, as shown in Table 5. This means that magnetised water reduced the effect of water shortage (deficit irrigation) on the growth of tomato plants because the effect was not statistically significant. The statistical analysis for the tomato plant irrigated with non-magnetised water with deficit irrigation had a significant effect on the growth of the tomato plants.

Table 2

Mean height of tomato plants treated with magnetised water and non-magnetised water

Date	Days after planting	Type of treatment	Tomato plant height (mm)			
			T_1	T_2	T_3	T_4
1	2	3	4	5	6	7
30/10/2014	37	Magnetically treated water	336.3	300.0	320.0	348.8
30/10/2014	37	Non-magnetically treated water	282.5	240.0	250.0	215.0
03/11/2014	41	Magnetically treated water	415.0	376.3	416.3	452.5
03/11/2014	41	Non-magnetic treated water	385.0	333.8	343.8	290.0
09/11/2014	47	Magnetic treated water	545.0	537.5	540.0	523.8
09/11/2014	47	Non-magnetically treated water	531.3	487.5	505.0	372.5
12/11/2014	50	Magnetic treated water	628.8	630.0	600.0	562.6
12/11/2014	50	Non-magnetically treated water	601.3	578.8	557.5	447.5

T_1 = 100% water requirement supplied, T_2 = 80%, T_3 = 60%, and T_4 = 50%. Tomato plants were transplanted on 19 October 2014 after 26 days at the nursery (planted on 23 September 2014).

Table 3
Mean diameter of the stem of tomato plants irrigated with magnetised water and non-magnetised water measured 30 mm above the soil level

Date	Days after planting	Type of treatment	Stem diameter of tomato plant (mm)			
			T_1	T_2	T_3	T_4
1	2	3	4	5	6	7
01/11/2014	39	Magnetically treated water	4.58	4.50	4.53	4.30
01/11/2014	39	Non-magnetically treated water	4.20	4.04	3.73	3.48
09/11/2014	47	Magnetic treated water	7.18	7.70	7.53	7.23
09/11/2014	47	Non-magnetically treated water	6.95	7.25	6.75	5.85

T_1, T_2, T_3 and T_4 were as previously as in Table 3.

Table 4
ANOVA for the height of tomato plants with magnetised water

Source of error	Degree of freedom (D.F)	Sum of square (SS)	Mean square (MS)	Calculated F	Tabular F at P ≤ 5%
1	2	3	4	5	6
Treatment	3	120.797	40.27	2.44	3.49
Error	12	197.917	16.49		
Total	15	318.714			

Table 5
ANOVA for the height of tomato plant with non-magnetised water

Source of error	Degree of freedom (D.F)	Sum of square (SS)	Mean square (MS)	Calculated F	Tabular F at P ≤ 5%
1	2	3	4	5	5
Treatment	3	558.375	186.125	8.97	3.49
Error	12	248.875	20.74		
Total	15	807.25			

Fig. 1
Tomato plants irrigated with magnetically treated water

Fig. 2
Tomato plants irrigated with non-magnetically treated water

Tomato yield

The results of the yields obtained from magnetically treated water and the yields from non-magnetically treated water at 100%, 80%, 60% and 50 % water requirements are shown in Table 6. The total yields of tomatoes from magnetically treated water with 100%, 80%, 60% and 50% water requirements were 587.8 g, 441.7 g, 410.7 g and 312.4 g per bucket (g/tomato stand), respectively, while the yields from non-magnetically treated water were 439.9 g, 379.5 g, 374.6 g and 236.6 g per tomato stand, respectively. Magnetically treated water produced a higher yield than non-magnetically treated water because MTW can alleviate the effect of water stress or deficit irrigation on crop (Anand et al. 2012, Aoda and Fattah, 2011). The yield of tomatoes irrigated with magnetised and non-magnetised water is shown in Figure 3. The variation of the tomato yields from magnetically treated water based on percentage levels of water requirement applied as the treatments was not statistically significant because the calculated value of F (F_{cal} =1.24) was lower than the Table value (F_{Tab} = 3.49 at $p \leq 5\%$), and that of non-magnetised water was not significant as well, as shown in the ANOVA Tables 7 and 8. The percentage increments in yields of tomato with magnetically treated water for T_1, T_2, T_3 and T_4 were 33.62%, 16.44%, 9.64% and 32.09%, respectively, when compared with the yields obtained from the non-magnetically treated water. The increment in the yield of tomato plants irrigated with magnetically treated water was in agreement with the results obtained by other researchers (Babu, 2010, Dhawi, 2014, Maheshwari and Grewal, 2009 and Moussa, 2011).

With the paired t test statistical analysis to compare the yield of tomato plants irrigated with MTW and NMTW, the calculated value of t (t_{cal}) was 3.367, while the Table value of t (t_{Tab}) was 3.182 when the

Table 6

Tomato yield from the water stress experiment

Row	Tomato yield irrigated with magnetised water (g)				Tomato yield irrigated with non-magnetised water (g)			
	T_1	T_2	T_3	T_4	T_1	T_2	T_3	T_4
1	2	3	4	5	6	7	8	9
1	155.5	101.0	223.6	85.6	90.9	86.0	150.1	100.5
2	115.2	169.9	77.8	108.3	170.9	141.9	16.2	20.6
3	190.2	64.2	61.8	78.0	159.6	97.8	117.9	97.5
4	126.9	106.8	47.5	40.5	18.5	53.8	90.4	17.9
Total	**587.8**	**441.9**	**410.7**	**312.4**	**439.9**	**379.5**	**374.6**	**236.5**
Mean	**146.95**	**110.48**	**102.68**	**78.10**	**109.98**	**94.88**	**93.65**	**59.13**

T_1 = 100% water requirement supplied, T_2 = 80%, T_3 = 60% and T_4 = 50%.

MW = magnetised water (treated with 719 G) and NMW = non-magnetised water.

Table 7

ANOVA for the yield of tomato with magnetically treated water

Source of error	Degree of freedom (D.F)	Sum of square (SS)	Mean square (MS)	Calculated F	Tabular F at $p \leq 5\%$
1	2	3	4	5	6
Treatment	3	9,743.94	3,247.98	1.24	3.49
Error	12	31,468.44	2,622.37		
Total	15	41,212.38			

degree of freedom was 3 at α = 0.05 ($\alpha = 5/2 = 0.025$) ($t_{cal} = 3.367 > t_{Tab} = 3.182$). This means that the yield of tomato plants produced using magnetised water to irrigate the tomato plants was statistically significant when compared with the yield of tomato plants produced using non-magnetised water.

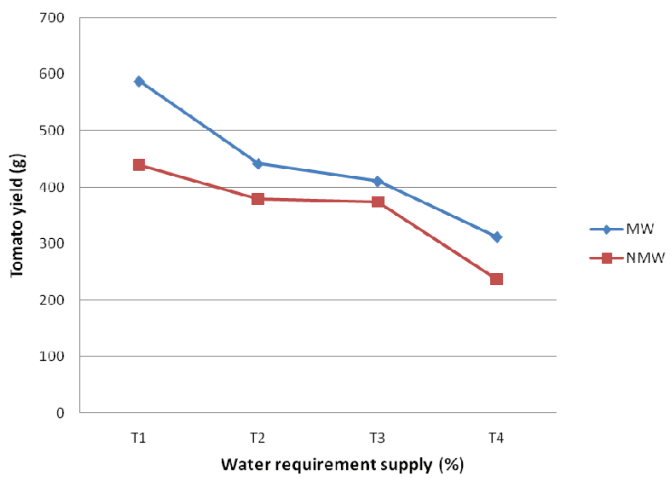
Table 8

ANOVA for the yield of tomato with non-magnetically treated water

Source of error	Degree of freedom (D.F)	Sum of square (SS)	Mean square (MS)	Calculated F	Tabular F at $p \leq 5\%$
1	2	3	4	5	6
Treatment	3	5,551.78	1,850.59	0.63	3.49
Error	12	35,043.79	2,920.32		
Total	15	40,595.59			

Fig. 3

Tomato yield from the water stress experiment irrigated with magnetised water (MW) and non-magnetised water (NMW).



T_1, T_2, T_3 and T_4 were as previously as in Table 3.

Conclusion

Magnetic treatment of irrigation water has an effect on the vegetative growth of tomato plants by increasing the rate of growth and the yield of tomatoes under deficit irrigation. The heights of tomato plants irrigated with magnetised water after 50 days for 100%, 80%, 60% and 50% water requirement were 628.8 mm, 630.0 mm, 600.0 mm and 562.6 mm, respectively, and the yields after 130 days were 587.8 g, 441.9 g, 410.7 g and 312.4 g per tomato stand, respectively. The heights of tomato plants with non-magnetised water were 601.3 mm, 578.8 mm, 557.5 mm and 447.5 mm, respectively, and the yields for T_1, T_2, T_3 and T_4 were 439.9 g, 379.5 g, 374.6 g and 236.6 g per tomato stand, respectively. The increment in the yield with magnetised water varied from 9.64% to 33.62% compared with the yield from non-magnetised water and the effect of magnetic water on the tomato yield was statistically significant. Magnetic flux density of 719 G inside the treatment chamber was adequate for the treatment of irrigation water and increased the yield of tomato by 9.64% to 33.62%.

References

Anand, A., Nagarajan, S., Verma, A. P. S., Joshi, D. K., Pathak, P. C. and Bhardwaj, J (2012). Pre – treatment of seeds with static magnetic field ameliorates soil water stress in seedling of maize (Zea mays L.), Indian Journal of Biochemistry and Biophysics, 49 (1): 63 – 70.

Aoda, M. I. and Fattah, M. A. (2011). The interactive effects of water magnetic treatment and deficit irrigation on plant productivity and water use efficiency of corn (zea mays l.). Iraqi Journal of Agricultural Sciences, 42:164-179.

Babu, C. (2010) Use of magnetic water and polymer in agriculture. Tropical Research, ID 08 – 806 – 001.

Chern, C. C. (2012) Application of magnetic water to stimulate the lady's finger (Abelmosculentus L.) moench

Dhawi, F (2014) Why magnetic fields are used to enhance a plant's growth and productivity? Journal of Annual Research and Review in Biology 4(6): 886 – 896. https://doi.org/10.9734/ARRB/2014/5983

Ejieji, C. J and Adeniran, K. A. 2009. Effect of water and fertilizer stress on the yield, fresh and dry matter production of grain amaranth. Australian Journal of Agricultural Engineering, 1(1):18-24.

El - Sayed, H. and Sayed A. (2014) Impact of magnetic water irrigation for improve the growth, chemical composition and yield production of broad bean (Vicia faba L.) Plant. American Journal of Experimental Agriculture, 4(4): 476-496. https://doi.org/10.9734/AJEA/2014/7468

Hozayn, M. and Abdul- Qados, A. M. S. (2010) Irrigation with magnetized water enhances growth, chemical constituent and yield of chickpea (Circer arietinum L.). Agriculture and Biology Journal of North America, 1(4): 671 – 676.

Kochmarsky, V. (1996) Magnetic treatment of water: possible mechanisms and conditions for applications. Magnetic and Electrical Separation, 7: 77-107. https://doi.org/10.1155/1996/89312

Kronenberg, K. J. (1985) Experimental evidence for effects of magnetic fields on moving water. IEEE Trans. on Magnetics, 21(5): 2059-2061. https://doi.org/10.1109/TMAG.1985.1064019

Maheshwari, R. L. and Grewal, H. S (2009) Magnetic treatment of irrigation water: its effects on vegetable crop yield and water productivity. Journal of Agricultural Water Management, 96 (8) :1229-1236. https://doi.org/10.1016/j.agwat.2009.03.016

McMahon, C. A. (2006) Investigation of the quality of water treated by magnetic fields. B. Eng. Thesis

Moussa, H. R. (2011) The impact of magnetic water application for improving common bean (Phaseolus vulgaris L.) production. New York Science Journal, 4(6): 15 – 20.

Muraji, M., Asai, T, Tatebe, W. (1998) Primary root growth rate of Zea mays seedlings grown in an alternating magnetic field of different frequencies. Biochem. Bioenerg. 44:271–273. https://doi.org/10.1016/S0302-4598(97)00079-2

Muraji, M., Nishimura, M., Tatebe, W., Fujii, T. (1992) Effect of alternating magnetic field on the growth of the primary root of corn. IEEE. Trans.Magn., 28: 1996-2000. https://doi.org/10.1109/20.144760

Noran, R., Shani, U and Lin, I. (1996). The effect of irrigation with magnetically treated water on the translocation of minerals in the soil. Magnetic and Electrical Separation, 7: 109-122. https://doi.org/10.1155/1996/46596

Ogunlela, A.O (2001) Stochastic Analysis of Rainfall Events in Ilorin, Nigeria. Journal of Agricultural

Podlesny, J., Pietruszewski, S. and Podleoena, A. (2004) Efficiency of the magnetic treatment of broad bean seeds cultivated under experimental plot conditions. Int. Agrophysics, 18: 65-71.

Suchitra, K. and Babu, E. A. (2011) A pilot study on silt magnetized and non-magnetized water in the on-farm water use efficiency management. Centre for Water Resources, Anna University, Chennai, India.

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Nepakankamo drėkinimo poveikis pomidorų (Solanum lycopersicum) augimui, drėkinant magnetizuotu vandeniu

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Šis tyrimas buvo atliktas siekiant nustatyti nepakankamo drėkinimo poveikį vegetatyviniam pomidorų (Solanum lycopersicum) auginimui ir derliui. Drėkinama buvo magnetizuotu vandeniu, kuriam magnetinis laukas sukuriamas elektromagnetu. Magnetinio srauto tankis, naudojamas drėkinimo vandens apdorojimui, siekė 719G. Pomidorų daigai (veislė UC82B), po 26 dienų daiginimo periodo, buvo persodinti į 16 kibirėlių (1 pomidorų daigas vienam kibirui). Pomidorai buvo auginami po skaidriu sodo stogu dar 94 dienas ir drėkinami magnetiškai apdorotu vandeniu. Kontrolinis eksperimentas taip pat buvo vykdomas su 16 kibirėlių (1 pomidoro daigas vienam kibirėliui) ir drėkinama ne magnetizuotu vandeniu. Šio tyrimo metu pomidorų augalai buvo drėkinami 100%, 80%, 60% ir 50% vandens poreikio (kai 1,3 litro priskiriama 100%). Atitinkamai buvo pažymėti keturi eksperimentai – T1, T2, T3 ir T4. Pomidorų aukštis su magnetizuotu vandeniu po 50 dienų buvo atitinkamai 628,8 mm, 630,0 mm, 600,0 mm ir 562,6 mm, o pomidorų derlius po 130 dienų buvo 587,8 g, 441,9 g, 410,7 g ir 312,4 g iš vieno pomidorų daigo. Pomidorų daigų aukštis be magnetizuoto vandens buvo atitinkamai 601,3 mm, 578,8 mm, 557,5 mm ir 447,5 mm, o T1, T2, T3 ir T4 derlius buvo 439,9 g, 379,5 g, 374,6 g ir 236,6 g iš vieno pomidorų daigo. Derliaus išeiga su magnetizuotu vandeniu padidėjo nuo 9,64% iki 33,62%, lyginant su nemagnetizuoto vandens išeiga, o magnetizuoto vandens poveikis pomidorų derliui buvo statistiškai reikšmingas.

Raktiniai žodžiai: drėkinimo trūkumas, magnetizuotas vanduo, pomidorai.