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# EFFECT OF MAGNETIC TREATMENT OF WATER ON EVAPOTRANSPIRATION OF TOMATO

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## Abstract

This study was conducted to determine the effect of magnetic treatment of water on the evapotranspiration of tomato plant. Evapotranspiration is important to plant for metabolic processes and it also cools the plant. Three magnetic flux densities of 124, 319 and 719 G produced from electromagnet (the treatments) labelled as $T_1$, $T_2$ and $T_3$ were used to treat the water and a control experiment ($T_C$) was also set up which was irrigated with non-magnetic treatment water. Equal amount of water was applied to all the tomato plant (variety UC82B) at the same time. Each treatment was replicated seven times given a total of 28 buckets containing tomato plant. The tomato was planted in the 28 buckets in a transparent garden shed for 130 days (23/09/2014 – 30/01/2015. A complete randomized design (CRD) experimental layout was used. The amount of water lost due to evapotranspiration per day was determined by weight lost in the bucket (lysimetric weighing method). The mean values of daily evapotranspiration for two stands of tomato plants per bucket over a period of 65 days for $T_1$, $T_2$, $T_3$ and $T_C$ were 9.38, 9.28, 9.18 and 8.03 mm/day respectively. The result of the evapotranspiration due to mass of water lost from the buckets containing tomato plants irrigated with magnetic water were all higher than the values of evapotranspiration from non-magnetic water. This indicated that tomato plant irrigated with magnetic treatment of water absorbed more water from the soil easily and grew faster than the tomato plant irrigated with non-magnetic treatment water with the same quantity of water applied to the tomato plant.

**Keywords:** consumptive use, evapotranspiration, irrigation, magnetic treatment of water, tomato

## 1. Introduction

Magnetic treatment of water has many applications in agriculture. It modifies bonding angle of water, surface tension and some physicochemical properties of water thereby making it easier for plant to absorb more water and this will increase the evapotranspiration (ET) rate of plant for all metabolic processes (Babu, 2010). This high ET value by magnetic treatment of water would enhance crop growth, high crop yield and high efficiency use of water (El – Sayed and Sayed, 2014; Hozayn and Abdul – Qados, 2010; Maheshwari and Grewal, 2009; McMahon, 2006 and Selim, 2008).

Evapotranspiration (ET) is also known as consumptive use (CU) and the term is the combination of evaporation and transpiration. Evapotranspiration is the quantity of water that leaves the plants and water that is removed from the soil surface. In the two processes, water is converted to water vapour and enters the atmosphere. Actually, consumptive use is the sum of evapotranspiration and water used by plant for its metabolic processes. Consumptive use exceeds evapotranspiration by the amount of water used for photosynthesis, transport of minerals and photosynthates, digestion of plant food, plant growth and structural support to plant. The actual water used for metabolic activities is insignificant because is less than 1% of evapotranspiration (Michael, 2008). Therefore, consumptive use is assumed to be equal to evapotranspiration. Crop evapotranspiration ($ET_c$) is the evapotranspiration of a crop under standard conditions. The standard conditions assumed a disease – free and well fertilized crop grown in large plot under optimum soil moisture conditions and obtaining optimum production under the prevailing climatic conditions.

Reference evapotranspiration is the evapotranspiration from a hypothetical reference crop with an assumed height of 0.12 m, a fixed surface resistance of 70s/m and an albedo of 0.23. The reference surface closely resembles an extensive area of actively growing grass of uniform height completely shading the ground and with sufficient soil moisture (Adeboye, *et al*, 2009; Allen *et al.*, 1998 as cited by Ejieji, 2011; Trajikovic and Gocic, 2010). Albedo is the fraction of the solar radiation which is reflected by the earth's surface and the value depends on the type of surface, angle of the incidence of sun's rays and slope of the ground surface (Michael, 2008). Reference evapotranspiration provides information on the evaporation demand of the atmosphere which is independent of the type of crop, its stage of development and the management practices. Soil factors do not affect reference evapotranspiration (Chineke *et al.*, 2011 and Michael, 2008). Reference evapotranspiration can be computed from weather data in a given location at any period of the year. Different methods are available for the determination of reference evapotranspiration as highlighted in Michael (2008). The objectives of this study were to determine the effect of magnetic treatment of water on the evapotranspiration and growth of tomato plant and.

## 2. Materials and Methods

The study was carried out at the Research farm land of the Department of Agricultural and Biosystems Engineering, University of Ilorin, Ilorin, Kwara State, Nigeria. Ilorin lies on the latitude $8^{o}30^{1}$N and longitude $4^{o}35^{1}$E at an elevation of about 340 m above mean sea level (Ejieji and Adeniran, 2009). Ilorin is in the Southern Guinea Savannah Ecological zone of Nigeria with annual rainfall of about 1300 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 was grown between 23rd September 2014 and 30th January 2015 varied from 16.5 to 30.0 $^{o}$C (wet bulb) and 23.5 to 38.0 $^{o}$C (dry bulb) with relative humidity of 50 to 90 %.

The magnetic flux densities used for treating the irrigation water were 124, 319 and 719 G (three treatments) inside the treatment chamber and a control experiment. The chemical properties of water before and after passing through magnetic field and the chemical properties of soil were shown in Table 1. Each of the treatment was replicated seven times and the tomato irrigated with non – magnetically treated water was also replicated seven times given a total of twenty eight (28) buckets containing tomato plant. The tomato was planted in the buckets on 23rd September, 2014 and equal volume of water (1.3 litres) was applied to each tomato at three (3) days irrigation interval but this irrigation interval reduced to 2 days at flowering/fruiting stage because water demand was higher and the value of crop coefficient ($k_c$) changed from 1.05 at 80 % canopy cover to 1.15 at 100 % canopy cover. Ufoegbune *el at.* (2012) also pointed out that the growing period of tomato was 150 days and the values of $k_c$ for initial growth stage, development stage, flowering/ fruiting stage and ripening stage were 0.45, 0.75, 1.15 and 0.80 respectively. Each of the 28 buckets was weighed immediately after irrigation and also weighed before the next irrigation after 2 or 3 days. The soil used was loam sand and the percentage contents of silt, clay and sand were 8.67, 5.76 and 85.57%, respectively. The irrigation water was allowed to pass through the electromagnetic treatment chamber four (4) times for duration of 113 s for effective treatment using circulation flowing method through magnetic field (Shoaili, 2003 as cited by Chern, 2012 and Mdsa'at, 2006).

Evapotranspiration of tomato, available water, net depth of irrigation requirement, irrigation interval and volume of required by tomato were determined from Equations (1), (2), (3), (4) and (5).

$$ET_c = K_c \times ET_o \quad (1)$$

$$AW = \frac{\rho_b}{\rho_w}\left(\frac{FC - WP}{100}\right) D_b \quad (2)$$

$$I_v = \frac{d_n}{ET_c} \quad (3)$$

$$V_{dp} = K_c \times ET_o \times C_c \times A_p \quad (4)$$

$$V_{days} = V_{dp} \times N_p \times I_v \quad (5)$$

where ETc is the crop evapotranspiration (mm/day), Kc is the crop coefficient, ETo is the reference evapotranspiration (mm/day), $\rho_b$ is soil bulk density (g/cm$^3$), $\rho_w$ is the density of water (g/cm$^3$), FC is the field capacity of the soil (%), $D_b$ is depth of the bucket (mm), Aw is the available water (mm), WP is the wilting point (%), $I_v$ is the irrigation interval (day), $d_n$ is the net depth of irrigation (mm), $V_{dp}$ is the volume of water required daily per plant (litre/day), $C_c$ is the crop canopy (%), $A_p$ is the area of the bucket (mm$^2$) and $N_p$ is the number of tomato stand in a bucket and $V_{days}$ is the volume of required by the tomato plant according to the number of days of irrigation interval. The values of ETc, AW, $d_n$, $I_v$, $V_{dp}$ and $V_{days}$ were determined as follows when the $k_c$ was 1.05, ETo was 4.7 mm/day, $\rho_b$ was 1.433 g/cm$^3$, $\rho_w$ was 1.000 g/cm$^3$, FC was 26.98 %, WP was 12.26 %, $N_p$ was 2, $I_v$ was 3 days and irrigation was done when 30 % of the irrigation water was depleted.

**Table 1:** Chemical properties of the soil and water used for irrigating the tomato plant

| Chemical properties of soil | | Chemical properties of water (mg/L) | | |
|---|---|---|---|---|
| Element | Mean | Element | MTW | NMTW |
| pH | 5.8 | pH | 7.46 | 7.36 |
| N (%) | 0.64 | $Ca^{+2}$ | 3.197 | 3.130 |
| P (mg/kg) | 2.74 | $Mg^{+2}$ | 1.229 | 1.285 |
| $Ca^{2+}$ (cmol/kg) | 1.37 | $K^+$ | 0.888 | 0.885 |
| $Mg^{2+}$ (cmol/kg) | 0.84 | $Na^+$ | 80.55 | 81.91 |
| $K^+$ (cmol/kg) | 2.24 | $Pb^{+2}$ | 0.297 | 0.300 |
| $Na^+$ (cmol/kg) | 1.15 | N ($NO_3^-$) | 43.07 | 42.73 |
| Organic matter (%) | 1.31 | $SO_4^{-2}$ | 50.06 | 47.80 |
| Organic carbon (%) | 0.86 | P | 0.654 | 0.670 |
| C.E.C | 5.74 | Viscosity (x $10^{-6}$ Ns/m) | 1.773 | 1.815 |

MTW = Magnetically-treated water, NMTW = Non-magnetically-treated water (water before passing through magnetic field)

## 2.1 Determination of the mass of water lost due to evapotranspiration

Mass of water lost due to evapotranspiration was determined directly from the bucket containing the tomato plant by weighing method (lysimeteric method). Each bucket with three treatments and the treatment was replicated seven times. Each bucket was weighed immediately after the irrigation and later weighed again before the next irrigation. The difference in the weight of the bucket was due to evapotranspiration because there was no space for percolation of irrigation water to the soil surface and become underground water. The mass of water lost to the atmosphere was due to evapotranspiration in kg which was equivalent to volume of water in litre as determined in 2.3 with the computed evpotranspiration in mm/day was shown in Table 2. Two samples of the readings obtained from the field measurement (raw data) were shown in Appendices A and B.

**2.2 Determination of the volume of water lost due to evapotranspiration**

The volume of water lost due to evapotranspiration was calculated from the mass of water lost to the atmosphere from the bucket containing the soil and tomato plant. Volume of water lost to evapotranspiration was determined from Equation (8) derived from Equations (6) and (7).

$$\rho_w = \frac{M_w}{V_w} \quad (6)$$

$$V_w = \frac{M_w}{\rho_w} \quad (7)$$

$$V_{wL} = M_w \quad (8)$$

where $\rho_w$ is the density of water (kg/m$^3$), $M_w$ is the mass of lost due to evapotranspiration (kg), $V_w$ is the volume of water lost from the bucket to evapotranspiration (m$^3$) and $V_{WL}$ is volume of water lost due to evapotranspiration (litres, L). The volume of water lost from each bucket for illustration was calculated as shown in the following expressions which were presented in Table 3. From the following calculations, mass of water lost from the bucket in kg is the same as volume of water lost from the bucket due to evapotranspiration in (L).

$$V_w = \frac{0.508}{1000} = 0.508 \times 10^{-3} m^3, V_m = 0.508 \times 10^{-3} \times 10^3 = 0.508\ litre$$

**2.3 Computation of evapotranspiration from mass of water lost due to ET**

Evapotranspiration (ET) of tomato in mm/day due to mass of water lost to atmosphere from the bucket was computed using Equation (9). An example of the computation for ETc value was shown in the following expression when the values of $V_{WL}$ and $A_P$ (area of the bucket) were 0.508 L (mass of water lost to ETc = 0.508 kg/day ≡ 0.508 L/day) and 0.05433m$^2$, respectively. The result of the mean values of evapotranspiration of tomato (ETc) and volume or mass of water lost from the bucket to the atmosphere was shown in Table 2.

$$ET_c = \frac{V_m}{A_p} \quad (9)$$

$ET_c = \frac{0.508}{0.05433} = 9.35\ mm/day$ for two stands of tomato plant per bucket.

**3. Results and Discussions**

The result of mass of water lost due to evapotranspiration which was evapotranspiration from the tomato in the bucket was shown in Table 2. The mass of water lost in kg was equivalent to the volume of water lost to evapotranspiration in litre as density of water is equal to 1000 kg/m$^3$. The value of mass of water lost to atmosphere daily was higher with tomato plant irrigated with the magnetically treated water (MTW) than the water lost from non–magnetically treated water (NMTW). This increased in the rate of water absorption for evapotranspiration in which 1 % of evapotranspiration is needed for metabolic processes of tomato plant which could contribute to the high growth rate of the tomato plant.

The graph shown in Figure 1 indicated that evapotranspiration of tomato MTW by 124, 319 and 719 G ($T_1$, $T_2$ and $T_3$) were higher than the evapotranspiration of tomato from NMTW ($T_c$). The mean values of the evapotranspiration of the tomato plant over the period of 65 days in the transparent garden shed were 9.38, 9.28, 9.18 and 8.03 mm/day, respectively. The bar chart in Figure 2 also indicated that tomato plant absorbed more water from the soil in the buckets containing magnetized water than the tomato in the non – magnetized water with evapotranspiration increased by 14.32 to 16.81 %. The rate of water absorption by the tomato plant for evapotranspiration was statistically significant. The calculated values of F were 8.10 and 7.08 while the Table value of F was 2.78 as shown in Tables 3 and 4. This means that for one stand of tomato plant in the bucket, the mean values of ETc for $T_1$, $T_2$, $T_3$ and $T_c$ were 4.69, 4.64, 4.59 and 4.02 mm/day while the theoretical ETc of tomato calculated as the water requirement of tomato at 80 % canopy cover in this study was 4.94 mm/day. This indicated that the mean values of $ET_c$ of tomato obtained by direct method (lysimetric method) from the bucket over a period of 65 days were close to the theoretical value of ET at its peak value. Similarly, the mean values of ETc obtained in this study for one stand of tomato plant by direct method were within the same values of the actual irrigation water requirement ($ET_c$) of drip irrigated tomato crop grown in tropical greenhouse environment varied from 4.1 to 5.6 mm/day (Harmanto *et al.*, 2005). Tomato plant in the transparent garden shed at 45 days irrigated with magnetically treated water (MTW) was shown in Fig. 3. The results of evapotranspiration showed that tomato plant absorbed more water from magnetically treated water than the non – magnetically treated water when the same quantity of water was applied to the tomato plant. This increased the rate of vegetative growth of tomato plant as shown in Table 5. This was in agreement with research of Helal (2010) in which he reported that magnetic treatment of water had effect on plant by increasing the activities of antioxidant enzymes, photosynthetic activity and photosynthetic pigments which enhanced the plants growth and productivity. The results of growth rate and evapotranspiration obtained from magnetically treated water were higher than the growth and evapotranspiration from the non – magnetic treated water which was also in agreement that magnetic treatment of water increased the nutrient uptake (Aoda and Fattah, 2011 and Babu, 2010).

**Table 2:** Mean value of the mass of water lost due to evapotranspiration (ETc) and the daily ET of tomato plant for 65 days (two stands of tomato plant per bucket)

| S/No | Date | Mass of water lost due to evapotranspiration (kg/day) | | | | Computed evapotranspiration of tomato due to water lost (mm/day) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | $T_1$ | $T_2$ | $T_3$ | $T_C$ | $T_1$ | $T_2$ | $T_3$ | $T_C$ |
| 1 | 27-30/10/2014 | 0.508 | 0.535 | 0.466 | 0.381 | 9.35 | 9.85 | 8.58 | 7.01 |
| 2 | 01-03/11/2014 | 0.290 | 0.370 | 0.355 | 0.375* | 5.34 | 6.81 | 6.53 | 6.90* |
| 3 | 05-09/11/2014 | 0.333 | 0.330 | 0.355 | 0.293 | 6.13 | 6.07 | 6.53 | 5.39 |
| 4 | 09-11/11/2014 | 0.380 | 0.400 | 0.372 | 0.332 | 6.99 | 7.36 | 6.85 | 6.12 |
| 5 | 12-14/11/2014 | 0.455 | 0.490 | 0.470 | 0.440 | 8.37 | 9.02 | 8.66 | 8.10 |
| 6 | 14-16/11/2014 | 0.375 | 0.390 | 0.385 | 0.335 | 6.90 | 7.18 | 7.09 | 6.17 |
| 7 | 16-18/11/2014 | 0.585 | 0.560 | 0.565 | 0.565 | 10.77 | 10.31 | 10.40 | 10.40 |
| 8 | 18-19/11/2014 | 0.400 | 0.400 | 0.420 | 0.220 | 7.36 | 7.36 | 7.73 | 4.05 |
| 9 | 19-22/11/2014 | 0.503 | 0.497 | 0.533 | 0.460 | 9.26 | 9.15 | 9.81 | 8.47 |
| 10 | 22-24/11/2014 | 0.360 | 0.355 | 0.375 | 0.285 | 6.63 | 6.53 | 6.90 | 5.25 |
| 11 | 25-28/11/2014 | 0.457 | 0.450 | 0.473 | 0.433 | 8.41 | 8.28 | 8.71 | 7.97 |
| 12 | 28-30/11/2014 | 0.565 | 0.520 | 0.515 | 0.490 | 10.40 | 9.57 | 9.48 | 9.02 |
| 13 | 30-02/12/2014 | 0.520 | 0.520 | 0.535 | 0.455 | 9.57 | 9.52 | 9.85 | 8.37 |
| 14 | 02-12/12/2014 | 0.590 | 0.570 | 0.605 | 0.500 | 10.86 | 10.49 | 11.14 | 9.20 |
| 15 | 04-07/12/2014 | 0.533 | 0.480 | 0.483 | 0.467 | 9.81 | 8.83 | 8.89 | 8.60 |
| 16 | 07-10/12/2014 | 0.470 | 0.477 | 0.467 | 0.350 | 8.65 | 8.78 | 8.60 | 6.44 |
| 17 | 10-12/12/2014 | 0.535 | 0.470 | 0.485 | 0.405 | 9.85 | 8.65 | 8.93 | 7.45 |
| 18 | 12-15/12/2014 | 0.473 | 0.447 | 0.443 | 0.397 | 8.71 | 8.23 | 8.15 | 7.31 |
| 19 | 15-17/12/2014 | 0.500 | 0.520 | 0.485 | 0.425 | 9.20 | 9.57 | 8.93 | 7.82 |
| 20 | 17-19/12/2014 | 0720 | 0.725 | 0.690 | 0.565 | 13.25 | 13.34 | 12.70 | 10.40 |
| 21 | 19-22/12/2014 | 0.393 | 0.440 | 0.420 | 0.347 | 7.23 | 8.10 | 7.73 | 6.39 |
| 22 | 22-24/12/2014 | 0.660 | 0.605 | 0.540 | 0.470 | 12.15 | 11.14 | 9.94 | 8.65 |
| 23 | 24-26/12/2014 | 0.695 | 0.605 | 0.655 | 0.605 | 12.79 | 11.14 | 12.06 | 11.14 |
| 24 | 27-29/12/2014 | 0.730 | 0.775 | 0.745 | 0.650 | 13.44 | 14.26 | 13.71 | 11.96 |
| 25 | 29-31/12/2014 | 0.710 | 0.675 | 0.635 | 0.660 | 13.07 | 12.42 | 11.69 | 12.15 |
| Mean | | 0.510 | 0.504 | 0.499 | 0.436 | 9.38 | 9.28 | 9.18 | 8.03 |
| ET for 1 tomato stand | | 0.255 | 0.252 | 0.250 | 0.218 | 4.69 | 4.64 | 4.59 | 4.02 |

$T_1$=magnetic water treated with 124 G, $T_2$ = 319 G, $T_3$ = 719 G and $T_C$ = non-magnetic water.

* = mass of water lost/evapotranspiration in which Tc (control experiment) was greater than the value obtained from $T_1$, $T_2$ and $T_3$ (each treatment was replicated 7 times).

**Table 3:** ANOVA for the evapotranspiration of tomato plant (data obtained on 27–30 October, 2014)

| Source of error | Degree of freedom (D.F) | Sum of square (SS) | Mean square (MS) | Calculated F | Tabular F at $P \leq 5\%$ |
|---|---|---|---|---|---|
| Treatment | 3 | 32.30 | 10.77 | 8.10 | 2.78 |
| Error | 24 | 31.90 | 1.33 | | |
| Total | 27 | | | | |

**Table 4:** ANOVA for the evapotranspiration of tomato plant (data obtained on 18–19 November, 2014)

| Source of error | Degree of freedom (D.F) | Sum of square (SS) | Mean square (MS) | Calculated F | Tabular F at $P \leq 5\%$ |
|---|---|---|---|---|---|
| Treatment | 3 | 62.704 | 20.901 | 7.08 | 2.78 |
| Error | 24 | 70.819 | 2.951 | | |
| Total | 27 | 133.523 | | | |

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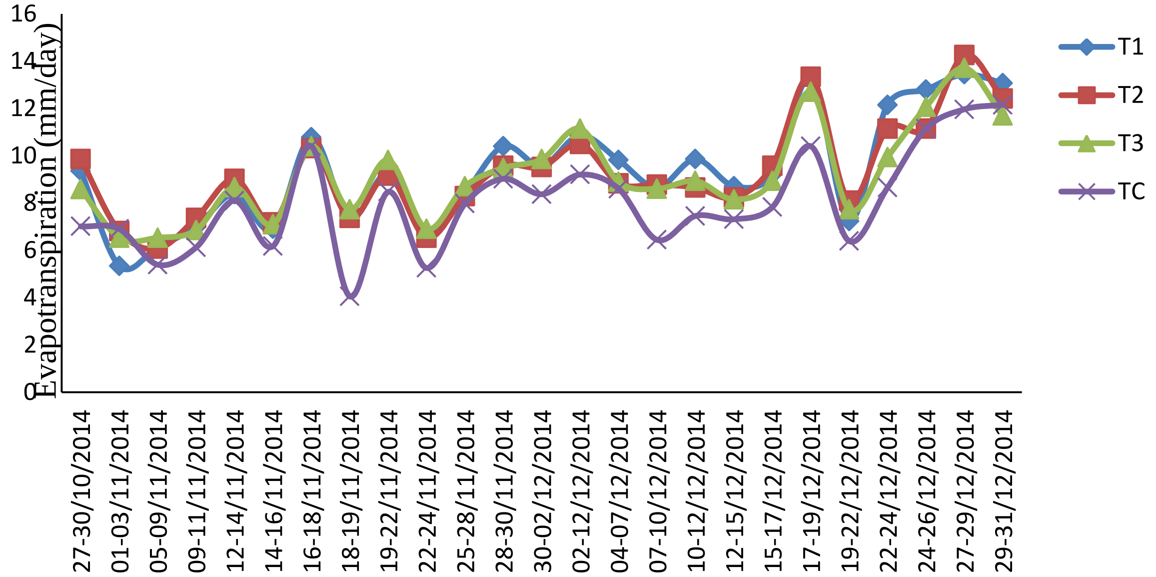
**Table 5:** Mean heights of the tomato plant during vegetative growth

| Date | Days after planting | Tomato plant height (mm) | | | |
|---|---|---|---|---|---|
| | | $T_1$ | $T_2$ | $T_3$ | $T_C$ |
| 10/2014 | 26 | 154.3 | 178.6 | 199.3 | 137.1 |
| 10/2014 | 32 | 302.1 | 325.0 | 330.0 | 243.6 |
| 10/2014 | 37 | 446.4 | 453.6 | 457.9 | 345.7 |
| 11/2014 | 41 | 515.0 | 532.0 | 530.0 | 407.9 |
| 11/2014 | 47 | 560.0 | 556.4 | 588.6 | 469.3 |

$T_1$=124 G, $T_2$=319 G, $T_3$=719 G and $T_C$ = 0.0 G ($T_C$ = Non – magnetically treated water) but $T_1$, $T_2$ and $T_3$ were magnetic water treated with the respective flux densities.




T1= Magnetized water treated with 124 G, T2 = 319 G, T3 = 719 G and TC = 0 G (Non – magnetized water).

**Figure 1:** Evapotranspiration of tomato plant obtained by direct method

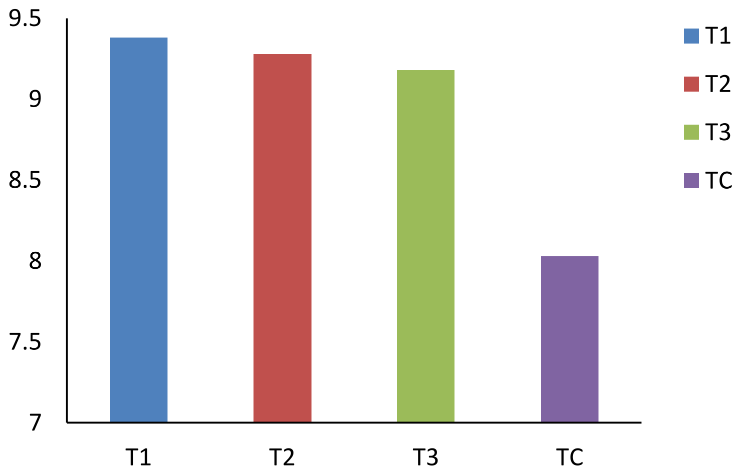



**Figure 2:** Mean evapotaranspiration of two stands of tomato plant per bucket over a period of 65 days (from 34 days after planting to maturity stage)

**Figure 3:** Tomato plant in garden shed at 45 days irrigated with magnetically treated water

## 4. Conclusion

Magnetic treatment of irrigation water increased the rate of water absorption by plant for evapotranspiration by 1.25 to 1.35 mm/day for two stands of tomato per bucket which eventually increased the rate of vegetative growth of the tomato plant.

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Appendix A Mass of the bucket with tomato plant recorded in the consumptive use experiment for the determination of evapotranspiration for the first and second readings.

| Row | Mass of the bucket with tomato plant for evapotranspiration (kg) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date | $T_1$ | $T_2$ | $T_3$ | Tc | Date | $T_1$ | $T_2$ | $T_3$ | $T_C$ |
| 1 | | 15.08 | 14.91 | 14.63 | 15.03 | | 13.21 | 12.98 | 13.15 | 13.89 |
| 2 | | 15.31 | 14.74 | 14.80 | 15.82 | | 13.61 | 13.38 | 13.72 | 14.57 |
| 3 | 27/10/2014 | 15.82 | 15.48 | 15.48 | 16.10 | 30/10/2014 | 14.17 | 14.06 | 14.06 | 14.91 |
| 4 | | 15.48 | 15.65 | 15.37 | 15.25 | | 14.00 | 14.00 | 13.83 | 14.17 |
| 5 | | 15.88 | 16.95 | 14.97 | 15.93 | | 14.46 | 15.20 | 13.32 | 14.74 |
| 6 | | 16.56 | 15.65 | 15.54 | 16.67 | | 15.37 | 14.06 | 14.17 | 15.65 |
| 7 | | 15.76 | 15.88 | 15.82 | 15.42 | | 14.40 | 14.34 | 14.57 | 14.29 |

$T_1$,$T_2$, $T_3$ and Tc were as previously defined in Table 2

Appendix B Mass difference in the bucket due to water lost to evapotranspiration in the consumptive use experiment.

| Row | Mass difference in the bucket due to water lost to evapotranspiration (kg) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Date | $T_1$ | $T_2$ | $T_3$ | Tc | Date | $T_1$ | $T_2$ | $T_3$ | $T_C$ |
| 1 | | 1.87 | 1.93 | 1.48 | 1.14 | | 0.54 | 0.74 | 1.08 | 0.91 |
| 2 | | 1.70 | 1.36 | 1.08 | 1.25 | | 0.57 | 0.96 | 0.79 | 0.62 |
| 3 | 27/10/2014 | 1.65 | 1.42 | 1.42 | 1.19 | 01/11/2014 | 0.51 | 0.62 | 0.62 | 0.74 |
| 4 | to | 1.48 | 1.65 | 1.54 | 1.08 | to | 0.57 | 0.74 | 0.57 | 0.74 |
| 5 | 30/10/2014 | 1.42 | 1.75 | 1.65 | 1.19 | 03/11/2014 | 0.51 | 0.74 | 0.74 | 0.62 |
| 6 | | 1.19 | 1.59 | 1.37 | 1.02 | | 0.51 | 0.68 | 0.57 | 0.74 |
| 7 | | 1.36 | 1.54 | 1.25 | 1.13 | | 0.85 | 0.68 | 0.57 | 0.85 |
| **Mean** | | **1.524** | **1.606** | **1.399** | **1.143** | **Mean** | **0.58** | **0.74** | **0.71** | **0.75** |
| **Kg/day** | | **0.508** | **0.535** | **0.466** | **0.381** | **Kg/day** | **0.290** | **0.370** | **0.355** | **0.375** |
| **mm/day** | | **9.35** | **9.85** | **8.58** | **7.01** | **mm/day** | **5.34** | **6.81** | **6.53** | **6.90** |

$T_1$, $T_2$, $T_3$ and Tc were as previously defined in Table 2