Effect of Magnetised Water on Chloride Ions in Trickle Irrigation

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Abstract

Inducing biochemical reactions by applying magnetic fields can help to simulate growth and productivity of crops. The method of magneto-hydro dynamical activity of natural water is a technique of applying magnetic field to change the physical and chemical parameters of water and hence modifying the filtration and dissolving properties. This will increase the assimilation of fertilizers and nutrients in plants and also increase the soil's ability to remove salts.Magnetic water is the water passed through a magnetic device or treated with magnetic field. The present research examines the effect of magnetic water on growth and yield of Amaranthus. The study was conducted by replicated pot experiments applying magnetically treated and normal tap water and saline water (EC=1mmhos/cm,2mmhos/cm and 3mmhos/cm) under controlled environmental conditions. A magnetic treatment device was used to induce with magnetic field of intensity 0.9360T and the irrigation water was treated with the same. The study revealed that irrigating with the magnetic water improved the plant yield significantly.

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1. INTRODUCTION

Soil salinity and water logging are two severe problems, whose impact is expanding day by day, which affects the productivity and sustainability of agriculture. Saline soils form one main entity of arid and semi arid eco systems. About, 9.38 million ha area in Inida is affected by salt affected soils, of which 5.5 million ha have saline soils where as 3.88 mission ha have alkaline soils. The area is spred from Jammu & Kashmir to Kanyakumari as well as Andaman & Nicobar islands to Gujarat. The increased demand of food production cannot be tackled if the available soil is affected. Usage of poor quality water causes further damage to soil health and hence its productivity. Soil toxicity, salinity, acidity, sodicity and water logging, deteriorates the quality as well and quantity of the crops. Also the soil health conditions limits the choice of crops that can be cultivated in the particular areas. Eventually many lands will not be suitable for further cultivation and become pasture lands.

Salinization of the soil is accelerated by using saline water continuously for crop cultivation. The value and productivity of agricultural fields can be dramatically reduced by high concentrations of soluble salts deposited in the soil. One of the biggest issues with many nations' agriculture is the use of low-quality, highly salinized irrigation water. Magnetized water can be used to recover soil and water, as well as to lessen soil salinity. Water that has been magnetised is created by passing it via electromagnets or permanent magnets that have been installed in or on a feed pipeline. The incoming water pipe is surrounded by electromagnets or permanent magnets.

Numerous variables, including the strength of the magnetic field, the direction of the applied magnetised field, the length of magnetic exposure, the flow rate of the solution, the presence of additives in the system, and the pH, affect the changes brought on by the magnetic influence. All the plants receiving magnetic water irrigation showed a striking improvement in their biochemical makeups and vegetative growth. The quality of irrigation water is affected by magnetic treatment, and the treated water helps to boost farm yields in crop farming, where yield is expressed as the amount and quality of the output as well as the specific economic contribution.

It is well recognised that for plants to function and photosynthesize effectively, the soil must have mineral salts and microelements. The majority of the nutrients in soil are not, however, utilised by plants. Only a small portion of the nutrients that are dissolved in the soil and made available to the plants during typical watering of plants. The main cause of a low crop and decreased growth rate is a lack of microelements/nutrients in the soil. That explains why magnetic water works well for irrigation. Mineral salts from the soil can be quickly dissolved in magnetised water, and no sediment is left on the soil's surface.Additionally, mineral and organic fertilisers dissolve better when utilised, which reduces the amount needed by 50% while allowing plants to continue growing naturally. As a result, agricultural products produce more crops and are of higher quality.

The interactions with dissolved particles in water that hold and attract hardening minerals like magnesium and calcium are made possible by installing a magnetic device inside the pipes. It is possible to increase productivity by creating a magnetic field and magnetically treating irrigation water. This will promote plant growth.

MTDs come in a wide variety today, with prices ranging from $100 to $10000. There is still no consensus on the contentious question of whether magnetised water is effective. MTDs have been successfully applied in various industrial settings in the west, including NASA systems, but the treatment has not yet been made widely available or accepted by the Water Quality Association (Federal Technology Alert, 1996). Around the world, research is progressing to produce more diverse magnetizers. The irrigation industry's use of magnetic water treatment technology will have a big positive impact on the environment worldwide.

According to Marshutz (1996), the Federal Trade Commission complained about the Evis Manufacturing Company, which produced an early magnetic water conditioner, in 1954. They accused the business of unfair competition and deceptive advertising by rivals. Two years later, the complaint was rejected after protracted proceedings. After many successful MTD uses emerged from the U.S.S.R., experiments and investigations increased in the west. In the 1990s, numerous reputable institutes were doing conflicting studies on the subject.

According to Donald McClellan of MC2 Resource Management, a distributor for the Descal-A-Matic Corp., "If you look at the publications and split them down the middle, you would find that anything written outside of the U.S. generally favours magnetic water treatment, while anything you read on the subject written inside the U.S. tends to be questionable" (Marshutz, 1996).

A material's ability to accept the flow of an electric charge is measured by its electrical conductivity. It is the reciprocal of the electric field strength to the current density. The Siemens per metre is a SI-derived unit. Information about electrical conductivity can be used to determine the purity of water, sort materials, verify that metals have been heated to the right temperature, and look for heat damage.in some material.

According to Malkin (2002), exposure to magnetic fields has an impact on the ions in the water. The structure of these compounds, which are what causes scale buildup in water pipes, kettles, and other appliances, changed as a result of the change in the ion states of both calcium carbonate and magnesium carbonate. This resulted in a significant decrease in scale buildup because of the loose nature of the ions, which may result in a decrease in EC for sample. Variable element fluctuations were seen in response to magnetic intensity.

A study on the impact of irrigation with water that has undergone magnetic treatment on the translocation of minerals in soil was carried out by Noran et al. in 1995. The precipitation and crystallisation of the solids in fluid solutions are influenced by the magnetic field's interactions with the surface charges of the particles there. These processes have a big impact on how minerals move around in irrigated soil. The K, N, P, Na, Ca+Mg, and total mineral content concentrations in the MTW-irrigated soil were compared to the same data in soil that was irrigated with conventional water. Three different leaching states of the soil were represented by the three different positions and distances from the dripper line where soil samples were taken. Regarding each mineral individually as well as the total mineral composition, different concentrations were discovered in at least one of the three locations.

In their study of the impact of magnetic fields on the stability of non-magnetic colloid particles, Higashitani and Oshitani (1996) proposed that magnetic fields have an impact on colloidal stability by changing the structure of the water molecules and ions either adsorbed on the particle surface or in the medium.

Magnetised treatment of irrigation water has not yet been tried in Kerala. So an attempt is made to raise Amaranthus in a protected structure. Replicated pot experiments are done using magnetised and non-magnetised water at different salt concentrations. The objectives of the study are:

1. To compare the effect of magnetised and non-magnetised water treatment at different salt concentrations on the growth parameters of Amaranthus.
2. To compare the effect of magnetisation of saline water with the non-magnetised water.
3. To study the effect of magnetised and non-magnetised water in different soils at different salt concentrations.

2. MATERIALS AND METHOD

A field study was conducted to evaluate the growth parameters of Amaranthus with magnetised and non-magnetised water at different soils. This chapter presents the materials used and methodology employed for experimentation, data collection and analysis of data.

2.1 Experimental site

The experiment was conducted inside a rain shelter made in the Instructional Farm of KCAET, Tavanur in Malappuram District, Kerala. The study area is situated at $10^0 52'30''$ North Latitude and 76^0 East longitudes.

2.2 Climatic conditions

Agroclimatically, the region is located on Kerala's boundary with the northern, central, and kole zones. The area receives rainfall from the South-West monsoon and to a certain extent from North-East monsoon. The average annual rainfall of the region varies from 2500 to 2900 mm.

The climatological data of the experimental site is shown below.

Mean maximum temperature: 42.1^0C
Mean minimum temperature: 22^0C
Average relative humidity : 42%
Average annual rainfall : 2000mm

2.3 Experimental setup

The seedlings of Amaranthus are grown inside a shade house with dimensions of $5 \times 10 m^2$. They are used to shield plants from the scorching sun, the thoughts, or very strong light. Plants can be shielded by a shade house from intense heat during the day or extreme cold in the middle of the night. Proper land preparation was done before the installation of the system in the field. A temporary shade house was constructed for carrying out the trial. It was made using bamboo and areca nut. The top of the shade house was covered with polythene sheets and the sides were covered with transparent or translucent material and ventilations were provided on all sides. The experimental setup is shown in Plate 1 and the layout is shown in Fig.3.1

Installation of irrigation system consisted of:

- Fitting of mains and sub-mains
- Fitting of filter unit and fertilizer unit.
- Laying of laterals and emitters

Plate 1.Experimental setup

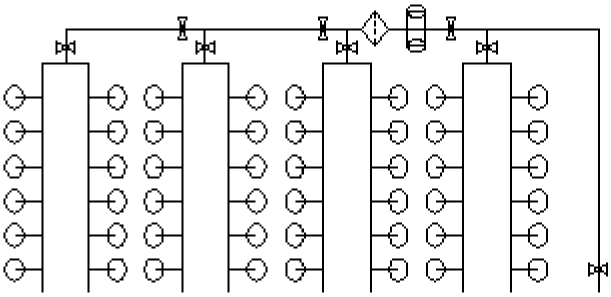

Fig.3.1 Layout of the experiment

S_1 - Sandy soil
S_2 -Sandy loam soil
T_1 -Magnetised potable water
T_2 -Non-magnetised potable water
T_3 -Magnetised water with EC= 1mmhos/cm
T_4 -Non-magnetised water with EC= 1mmhos/cm
T_5 -Magnetised water with EC= 2mmhos/cm
T_6 -Non-magnetised water with EC= 2mmhos/cm
T_7 -Magnetised water with EC= 3mmhos/cm
T_8 -Non-magnetised water with EC= 1mmhos/cm.

The methodology employed and equipments used for the experiment are given below.

2.3.1 Planting material

The seeds of Amaranthus seedlings were utilised as the planting material. The seeds were first sowed in seeding mixture on October 23, 2011, and regular drinkable water was used to establish the seedlings. Healthy seedlings were chosen for the study once they had grown to the requisite size, and on November 13, 2011, they were transferred into polythene bags.

2.3.2 Shade house experiment

The project utilised a Trickle Irrigation arrangement with a fully randomised block pattern. The trickle irrigation system consisted of four 0.75 inch PVC pipe subunits, each with two lines and six 12mm laterals located 0.6 metres apart. The system was supplied with water through a 1.5 inch PVC sub-main. Emitters of 4lph were given for each lateral. Each sub-unit had a control valve put at the beginning, and they were separated by 1 m. Water from a source was delivered to laterals at a desired pressure of 1 atmosphere using an electrical pump. In the experiment, out of the four sub-mains, one sub-main was provided with normal portable water, and the three sub-mains were provided with saline water at different concentrations. A fertilizer tank of 30 liters capacity was used for the mixing up of salt in water. A filter with nominal size of 30 mm nominal pressure of $2kg/cm^2$ and strainer element SS mesh 200 was used to avoid clogging of emitters. The attachment of fertilizer tank to the screen filter is shown in Plate 2.

2.3.3 Salinity levels

To create the requisite salinity levels in the drinkable water used in the study, measured amounts of NaCl salt were added. Three salinity levels were used for three sub-units in order to better understand how salinity levels affected water that had undergone magnetic treatment. The sensitivity of Amaranthus (2 mmhos/cm) to saline water was taken into consideration when choosing the salinity levels of irrigation water. Therefore the salinity levels were EC=1mmhos/cm, EC=2 mmhos/cm and EC=3 mmhos/cm, thus providing six irrigation water types, in which three were magnetically treated and three were non-treated.

The concentration of salt solution varies with the electrical conductivity and capacity of fertilizer tank. The measured amount of NaCl to be added to achieve the required salinity levels were done in the Soil and Water Testing lab of KVK. For the determination of EC, an EC-meter is used ,which is calibrated using 0.01N KCl solution. After calibration, the portable water was poured into a 1l beaker and the rods of EC-meter were immersed in it. The salt is then added to the water and stirred thoroughly. The quantities of salt added inorder to attain the three EC values were then recorded.

Plate 2. Fertilizer tank attached to screen filter

We applied statistical principles, replication, and randomization in these trials to produce statistically valid and unbiased estimates of treatment means, treatment differences, and experimental error. The study had a fully randomised design with three replications of each treatment.

2.3.4 Magnetic treatment

Before applying to the plants, several irrigation water types were treated with a magnetic device. The mean values of several irrigation water types' pH, EC, N, P, and K values before and after magnetic treatment are shown in Fig. 1, and values are provided in the Appendix. While there is no obvious pattern for EC values, magnetic treatment of water tends to modestly alter the pH of the water. The magnetic treatment of water had no effect on the N, P, and K content values of the various water types.

For the magnetic treatment of irrigation water, the Magnetic Fluid Conditioner, PERMAG N406, with its magnetic field of 0.9360T, was employed. The device was 3.5 inches long and can fit pipes that are 0.5-0.75 inches in diameter. Irrigation water was run through the magnetic treatment apparatus for magnetic treatment

2.3.5 Treatments

Treatment with non-saline water

In this treatment, portable water is pumped to irrigate in which salt is not added. In this setup, one line was non-magnetised and the other was magnetised, using the Magnetic Fluid Conditioner. Each line had three replications of two types of soil, which made a total of six plants. The plants were watered for 30 minutes, as the water requirement of Amaranthus is 2lph. During the treatment, the valve to all other sub-units is closed.

Treatment with saline water of EC-2 mmhos/cm

In this treatment, the valve of the first, second and fourth sub-units are closed and then the weighed salt for EC-2 is added into the fertilizer tank, which passes through the filter, and reaches the third sub-unit. This sub-unit also has two lines in which one is magnetised and the other is non-magnetised. This is also continued for time of 30 minutes and then stopped.

Treatment with saline water of EC-3 mmhos/cm

In this treatment, the weighed salt for EC-3 is added into the fertilizer tank, which passes through the filter, and reaches the fourth sub-unit. The valves for all other treatments are closed during this time. This sub-unit also has two lines in which one is magnetised and the other is non-magnetised. This is also continued for time of 30 minutes and then stopped.

Plate 3. Permag N046 Magnetic fluid conditioner

Plate 4. Magnetic fluid conditioner attached to control line

2.3.6 Soil texture

The particle size analysis performed using sieve analysis for coarse grained fraction. The soil was collected from the experimental field at a depth of 40cm from the soil surface. The soil sample was oven-dried and passed through a set of IS sieves of size 2mm, 1mm, 600 micron, 425 micron, 300 micron, 212 micron, 150 micron and 75 micron for sieve analysis. The percentage finer was calculated on the basis of percentage of soil retained in each sieve. The values for sandy soil is shown in Appendix VI and for sandy loam soil is shown in Appendix VII.

2.4 Observations taken

1) Temperature and relative humidity under the shade house.
2) Shoot length and root length
3) Number of branches per plant.
4) Number of leaves.
5) Yield

2.4.1 Temperature

The temperature inside the shade house was taken using a thermo-hygroclock. The temperature during the day time and night time was recorded using the thermo-hygroclock.

2.4.2 Relative humidity

Relative humidity was recorded using the thermo-hygroclock.

2.4.3 Shoot and root length

The plants were pulled out from each treatment at 30 days after transplanting. The root length and shoot length were measured using a scale.

2.4.4 Electrical conductivity

The EC of magnetised and non-magnetised water of controlled and saline water is measured using the EC-meter. It is done by inserting the rods of EC-meter into the water samples. In soil, 10g soil sample is taken and 25ml distilled water is added and stirred well. Allow it to settle for half an hour. Using this solution EC is measured.

2.4.5 pH

The pH of magnetised and non-magnetised water of controlled and saline water is measured using the pH-meter. It is done by inserting the rod of pH-meter into the water samples. In soil,10g soil sample is taken and 25ml distilled water is added, and stirred well. Allow it to settle for half an hour. Using this solution EC is measured.

2.4.6 Nitrogen

A surplus of alkaline KMnO4 solution is combined with 5g of known weight of soil. In the distillation unit, fit the tube. 2.5% NaOH solution should be added in 25ml using the dosing pump. 20 ml of 2.5% boric acid should be pipetted into a conical flask before the receiving end is submerged. Separate the NH3 gas from the tube, then gather the receiver acid. Tirate with 0.02 NH_2SO_4 after adding 5 drops of mixed indicator.

Calculations:

Available N = $(14 \times \text{Titrating value} \times 0.02\ \text{N} \times 2.24 \times 10^6) \div (5 \times 1000)$.kg/ha of soil

2.4.7 Potassium

To 5 gram soil sample add 25 ml neutral CH_3COONH_4 and then shake it for 5 minutes. Then filter the solution. Reading was taken using flame photometer.

Calculations:

Available Potassium, K (mg/kg soil) = photometer value×5

Available Potassium, K (Kg/ha) = Available K × 2.24

2.4.8 Phosphorous

A 5 gm soil sample is weighed and 50ml Bray no: 1 is added. Shake it well for 5 minutes. Filter the solution through a filter paper and pipette out 5ml into 25 ml standard flask and 4ml Reagent-B. Make it up to 25ml read the intensity of colour after 10 minutes using Spectro photometer.

Calculations:

Available P (mg/Kg soil) = Absorbance for sample / slope of standard curve × 50

Available P (Kg/ha) = Available P (mg/Kg soil) × 2.24

2.5 Statistical analysis and interpretation of data

ANOVA was used for the analysis and interpretation of data obtained in these experiments. The statistical design used for the study is Randomized Complete Block Design with eight treatments and three replications of each soil type. The soil types used where sandy soil and sandy loam soil. Therefore, a total of sixteen treatments were used for the study. The layout of the experiment is given in Fig.3.1

3. RESULTS AND DISCUSSION

The results of the field study conducted to evaluate the effects of magnetisation on chloride ions in trickle irrigation system are *discussed* in this chapter.

The experiment was conducted in Amaranthus crop and total eight treatments, consisting of magnetised and non-magnetised water were given alternatively. Each treatment was given in two types of soils. These treatments had 3 replications each. The treatments are then compared on the basis of magnetisation effects.

3.1 Effects of magnetization in water

The magnetization effects caused changes in the EC, pH and N, P, K of normal and saline water given to plants.

3.1.1 Electrical conductivity

In case of EC of water, a slight reduction in the EC was observed, when it is magnetised. The variations in EC are shown in the Fig.4.1and values are shown in Appendix V. From the observations, It is clear that magnetization of saline water with EC= 3 mmhos/cm is comparable with the non-magnetised treatment of EC=2 mmhos/cm. Magnetic treatment gave less change to control for EC=3 mmhos/cm, which gave a higher change. Changes in EC=2 mmhos/cm and EC=3 mmhos/cm were comparable.

3.1.2 pH

In case of pH of water, there were changes in magnetised water than the non-magnetised one. The variations in the pH of water used for the treatment are shown in Fig.4.2 and values are shown in Appendix V. In all the treatments pH varied in the same range, except for EC= 1, which showed a difference of 0.08. In general, the treatment of irrigation water with magnetic field reduced their pH.

3.1.3 N, P and K

The magnetic treatment of irrigation water showed significant changes only in the P in water, whereas N and K did not show a noticeable difference in the concentration. The values are shown in Appendix V. The variations in N, P and K of water used for the treatment is shown in Fig.4.3, Fig.4.4 and Fig.4.5 respectively

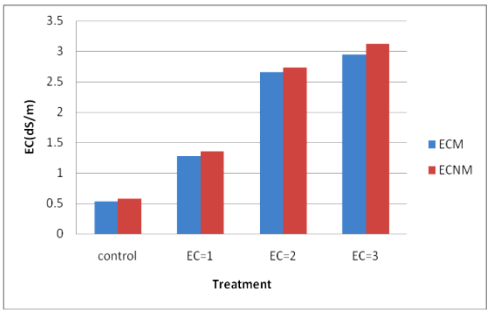

Fig.4.1 Variation of EC of water due to magnetization

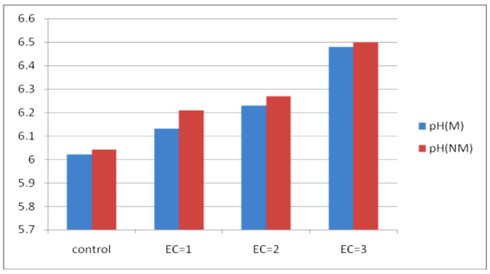

Fig.4.2 Variation of pH of water due to magnetisation

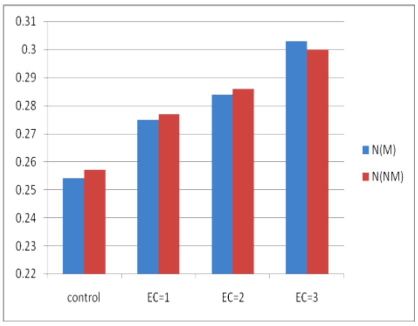

Fig.4.3 Variation of N of water due to magnetisation

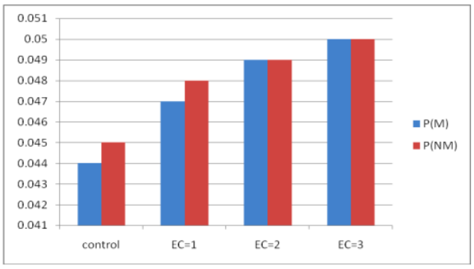

Fig.4.4 Variation of P of water due to magnetisation

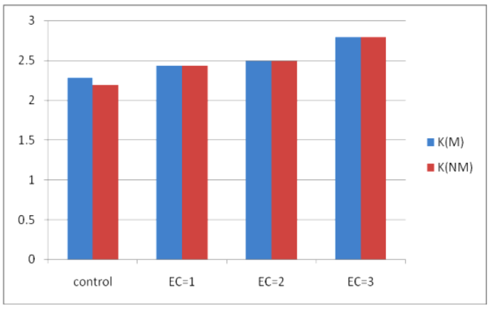

Fig.4.5 Variation of K of water due to magnetisation

3.2 Effects of magnetization in plant

3.2.1 Yield of plant

Based on the fresh weight and dry weight of the shoot, there were varied impacts of magnetic treatments of various irrigation water types on yield on both soils. The interactions between magnetic treatment, non-magnetic treatment, and various irrigation water types show a notable improvement in yield, especially for magnetised water treatment on EC=2 mmhos/cm and EC=3 mmhos/cm. The yield of plants obtained from magnetised water was more than that obtained from the non-magnetised one, but varied with soil type. Plants grown in the sandy loam soil, gave much better yield than the sandy soil. The effects of magnetic water treatment of irrigation water on mean values of plant yield parameters are given in the Fig.4.6.The comparison of crop between magnetised and non-magnetised water in sandy soil and sandy loam soil is shown in Plate 5 and Plate 6 respectively.

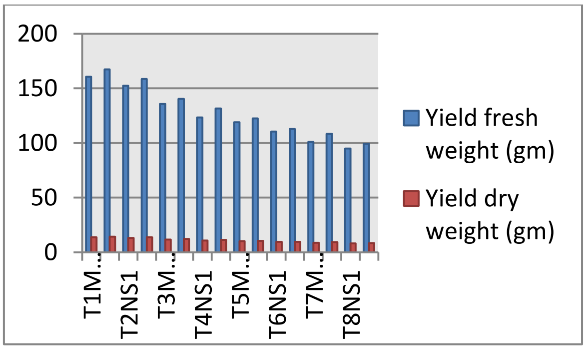

Fig.4.6 Yield variation due to magnetization

Plate 5 Comparison of crop between magnetised and non-magnetised water in sandy soil

Plate 6 Comparison of crop between magnetised and non-magnetised water in sandy loam soil

3.2.2 Root length

There was a drastic increase in the root length of plants irrigated with magnetised water, compared with the non-magnetised water under all treatments, but it varied with the type of soil. Plants grown in the soil sandy loam soil, were much better in root growth than the sandy soil.The variations on the root length of plants irrigated by magnetised and non-magnetised water is shown in Fig.4.7. for sandy soil and in Fig.4.8. for sandy loam soil and values are given in Appendix II.The average values are given in Table 1. The comparison of root length using magnetised and non-magnetised water for different treatments and soil is shown in Plate 7.

3.2.3 Shoot length

The shoot length of plants obtained from magnetised water was more than that obtained from the non-magnetised one, but varied with soil type. Plants grown in the soil sandy loam soil, were much better in shoot growth than in the sandy soil. The variations on the shoot length of plants treated with magnetised and non-magnetised water is shown in Fig.4.9. for sandy soil and in Fig.4.10. for sandy loam soil and their values are given in Appendix III and average values are shown in Table 3. The comparison of shoot length using magnetised and non- magnetised water for different treatments and soil is shown in Plate 7.

Plate 7 Comparison of root length and shoot length using magnetised and non- magnetised water for different treatments and soil

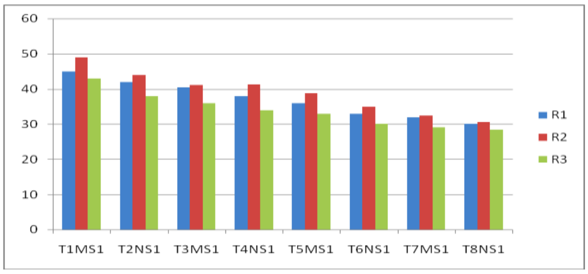

Fig.4.7 Variation of root length due to magnetization in sandy soil

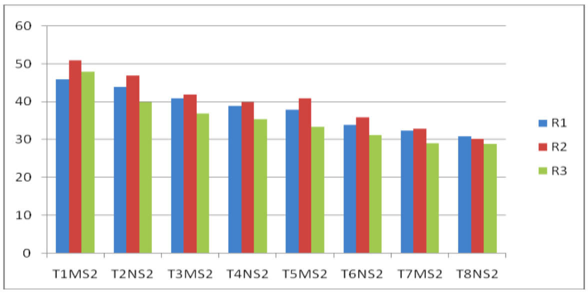

Fig.4.8 Variation of root length due to magnetization in sandy loam soil

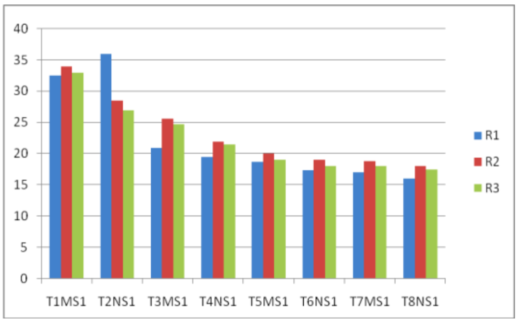

Fig.4.9 Variation of shoot length due to magnetization in sandy soil

Table 1. Average root length of plants under different treatments

Treatment	Average root length(cm)
T_1MS_1	45.66
T_1MS2	48.33
T_2NS_1	41.33
T_2NS_2	43.66
T_3MS_1	39.2
T_3MS_2	40
T_4NS_1	37.73
T_4NS_2	38.16
T_5MS_1	35.9
T_5MS_2	37.5
T_6NS_1	32.6

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T_6NS_2	33.73
T_7MS_1	31.16
T_7MS_2	31.5
T_8NS_1	29.67
T_8NS_2	30.06

Table 2. ANOVA table for root length of plants

Source	**Degree of freedom**	**Sum of squares**	**Mean value**	**F value**	**Table value**	**Remarks**
Blocks	2	193.59	96.79	74.07	3.32	“
Treatment	15	1435.98	95.73	73.26	2.04	“
Error	30	39.20	1.31			
Total	47	1668.77				

CD=1.91

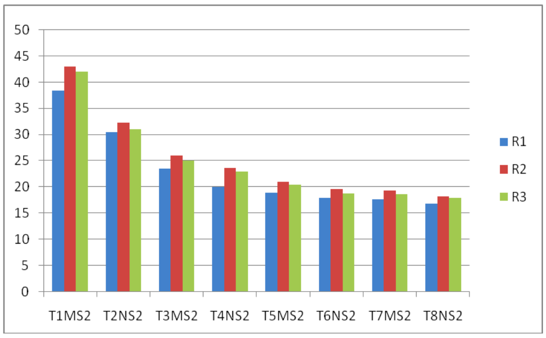

Fig4.10 Variation of shoot length due to magnetization in sandy loam soil

Table 3.Average shoot length of plants under different treatments

Treatment	Average Shoot length(cm)
T_1MS_1	33.16
T_1MS2	41.16
T_2NS_1	27.16
T_2NS_2	31.26

T_3MS_1	23.76
T_3MS_2	24.8
T_4NS_1	21
T_4NS_2	22.23
T_5MS_1	19.23
T_5MS_2	20.16
T_6NS_1	18.16
T_6NS_2	18.83
T_7MS_1	17.93
T_7MS_2	18.56
T_8NS_1	17.16
T_8NS_2	17.7

Table 4. ANOVA table for shoot length of plants

Source	**Degrees of freedom**	**Sum of squares**	**Mean square**	**F value**	**Table value**	**Remarks**
Blocks	2	43.99	21.99	56.76	3.32	*
Treatment	15	2090.44	139.36	359.65	2.04	*
Error	30	11.63	0.39			
Total	47	2146.05				

CD=1.04

3.3 Effects of magnetization in soil physical properties

3.3.1 Soil Texture

The results of the soil textural analysis are shown in Appendices VI and VII. The results of the sieve analysis were plotted to get particle size distribution curve.. In this curve percentage finer 'N' was taken as ordinate and particle diameter (mm) as abscissa on logarithmic scale. The sandy soil showed a C_u of 2.66 and C_c of 1.62, while the sandy loam soil showed a C_u of 2.91 and C_c of

1.48. As per the USDA classification chart, the textural classes of the soils are found to be well-graded soil.

3.3.2 Soil EC

When compared to the control, the magnetic treatment had a substantial impact on the EC value of the plants after harvest. Particularly, the soil EC values significantly increased when the water was magnetically treated. Fig. 4.11 depicts the fluctuation in soil EC brought on by magnetization.

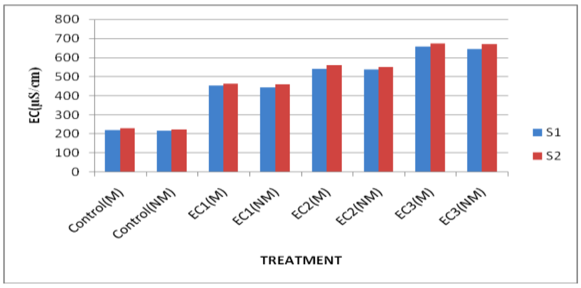

Fig.4.11 Variation of Soil EC due to magnetisation

3.3.3Soil pH

The pH of the soil was impacted by the magnetic treatment of irrigation water for both soil types. When compared to the control, irrigation of the two soil types with magnetically treated water considerably lowered the pH of the soil after harvest. Figure 4.12 illustrates how magnetization affects soil pH.

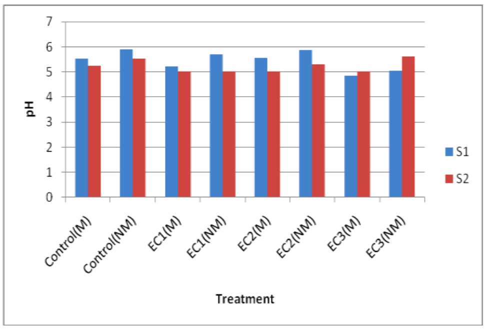

Fig.4.12 Variation of soil pH due to magnetisation

3.3.4 Soil N, P and K

In the current study, an increase in soil P and K availability, especially when saline water and magnetically treated water were used for irrigation, seems to have contributed in some way to yield improvement. The desorption of P and K from soil may be influenced by magnetic treatment of water, which would increase its availability to plants and promote better plant growth. Figures 4.13, 4.14, and 4.15, respectively, depict the variance of soil P, N, and K.

P(mg/kg

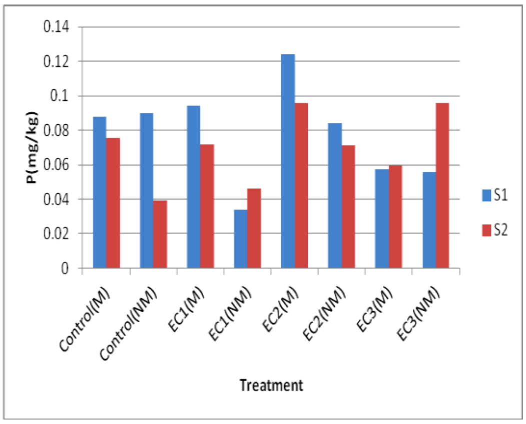

Fig.4.13 Variation of Soil P due to magnetisation

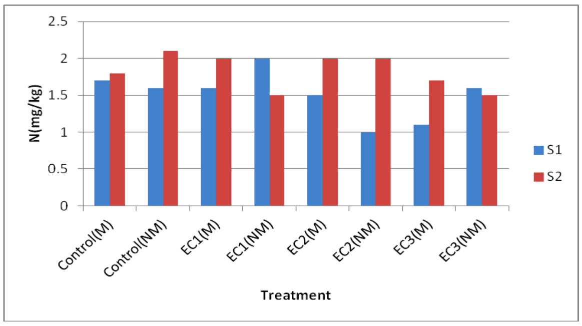

Fig.4.14 Variation of Soil N due to magnetisation

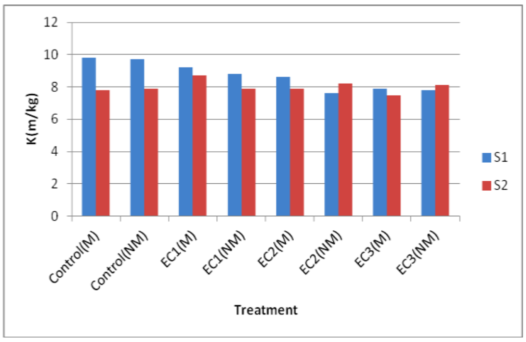

Fig.4.15 Variation of soil K due to magnetisation

4. SUMMARY AND CONCLUSION

The study was conducted to evaluate the effect of magnetised water treatments on chloride ions in trickle irrigation system and to compare it with the non- magnetised water treatment. The effect of magnetised water on plant, soil and water were taken into consideration. The treatments given consisted of normal water and water with different salt concentrations (EC=1 mmhos/cm, EC=2 mmhos/cm, EC=3 mmhos/cm) and each type of water was supplied as magnetised and non-magnetised. The comparison was evaluated in terms of shoot and root length of plants, and EC, pH and NPK of soil and water exposed to magnetic-field.

The results obtained from the present study can be summarised as follows.

The magnetic treatment of irrigation water resulted in statistically significant increase in the yield of plants in both soils, but it was greater in soil S_2 than in soil S_1. The root length of the plants treated under magnetised water showed remarkable increase than the non-magnetised water. Similarly, shoot length also increased in case of magnetisation.

The magnetic treatment of irrigated water tends to decrease the EC of water, under all conditions and it was found that magnetised water treatment of EC=3 mmhos/cm was given to plants it developed a potential to grow than the non-magnetised water treatment. Amaranthus is salt tolerant upto an EC=2 mmhos/cm only .The pH of the water also increased after the exposure to magnetic field treatment in fresh water as well as in different salt concentrations of water. In case of nutrients in water, there was a noticeable increase in the concentration of P than the N and K.

When compared to the control, the magnetic treatment had a substantial impact on the EC value of the plants after harvest. Particularly, the soil EC values significantly increased when the water was magnetically treated.

The pH of the soil was impacted by the magnetic treatment of irrigation water for both soils. When compared to the control, irrigation of two soils with magnetically treated water dramatically lowered soil pH after harvest.

In the current study, an increase in soil P and K availability, especially when saline water and magnetically treated water were used for irrigation, seems to have contributed in some way to yield improvement. The desorption of P and K from soil may be influenced by magnetic treatment of water, which would increase its availability to plants and promote better plant growth.

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