SULTANA ET AL (2020), *FUUAST J.BIOL.*, 10(2): 153-157



# MAGNETIZED IRRIGATION WATER TREATMENT FOR RESOLVING SALINITY STRESS

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**خلاصہ**

نمکین مٹی کا تدارک آج کل کے دنوں میں ایک بہت بڑا مسئلہ ہے۔ موجودہ مطالعہ نصرت جہاں کالج ربوہ میں کیا گیا تھا تاکہ پرکھا جا ئے کہ مقناطیسی پانی کا کالے چنوں پر جو مختلف نمکیات کے درجوں پر اگائے گئے، کیسے اثرات مرتب ہوتے ہیں۔ جس ورائٹی کا مطالعہ کیا گیا وہ پاؤڈر۔9 تھی جو کہ نیشنل ایگریکلچر ریسرچ سنٹر سے لی گئ تھی۔
تجربہ مکمل طور بے ترتیب نمونہ پر مشتمل تھا جس میں دو ٹریٹمنٹ اور دو کنٹرول ساتھ ہی ہر ایک کی دو نقلیں تھیں۔ پورے تجربہ کے دوران پانی دینے کا عمل مقناطیسی آلہ کی مدد سے کیا گیا۔
جو عوامل زیرِ غور تھے وہ بڑھنے کی رفتار اور نمو تھے۔ اس عمل کو باقاعدہ مختلف دورانیہ کے ساتھ مشاہدہ کیا گیا۔ حیاتی کیمیائی تجزیوں میں اسکاربیٹ پراوکسیڈیز، ہائیڈروجن پراوکسیڈیز، ملانوڈائی ایلڈی ہایڈ اور ٹوٹل پروٹین کا اجزائے ترکیبی کئے گئے تاکہ نمکیات میں کمی کا تعین کیا جاسکے۔ آبپاشی مقناطیسی معالجے کے ساتھ ایک سود مند تکنیک ثابت ہوئی ہے جو نمکین مٹی اور پانی کے سخت اثرات سے نمٹنے میں مدد دیتی ہے

**Abstract**

Remediation of saline soil is the major contemporary issue. The current study was conducted in Nusrat Jahan College Rabwah to analyse the effectiveness of magnetic water treatment (MWT) on chick- pea (*Cicer arietinum*) irrigated or raised in different salinity levels of soil and water. Variety studied was Poador-9 that was taken from NARC (National agricultural research Centre).

Complete randomized design (CRD) with two treatments ($S_1$ EC:2850 uS/cm, $S_2$ EC:4830 uS/cm) and two controls with two replicates each was experimented. Irrigation was carried out by the usage of magnetic apparatus throughout the experiment. The parameters under consideration were the germination rate and growth. These were recorded at regular intervals of time. Biochemical analysis of Ascorbate peroxidase, Hydrogen peroxide, Malondialdehyde and Total Protein were carried out for the determination of decrease in salt stress level. Irrigation with magnetic treatment has proven to be a cost-effective technique to cope up with severe impacts of saline soil and water.

**Keywords**: Chick pea, seedlings, magnetic treatment, salinity, biochemical analysis.

## Introduction

Water constitute a large part of the plant body and is involved in several physiochemical functions such as cell structure, metabolic reactions and others. It is a necessary component for plant's growth and devolvement. Due to its chemical properties such as polar nature that makes it a universal solvent and thus dissolve several kinds of salts in different quantities which become available to plants. If these salts content are present in optimum proximity it enhances growth, developmental and metabolic activities. If the salt content is present in excess it can leads to salt stress or salinity and cause hindrance in normal plant activities (Sairam and Tyagi A. 2004).

The salt stress is a major part of concern in crops as abiotic stress because it causes decline in their size, number, yield and productivity (Parihar P. *et al.*, 2014). The multiple factors attributing seed germination are reduction in; environment availability, changes in mobilization of stored reserves and affecting structural organization of proteins (Demir İ and K. 2008). Hence, there is vast area of concern for researchers to accomplish in the area of increasing yield and productivity under salinity stress in order to cope with increase demand of food in world.

To cope up with salinity stress various methods can be applied through a number of biological, chemical and industrial parameters. Researchers are using conventional breeding, genetic engineering and marker assisted selection as a biological method. Drawbacks includes; costly, time consuming and technically demanding. Chemical approaches include chemical agents; gypsum ($CaSO_4.2H_2O$), calcite ($CaCO_3$), calcium chloride

($CaCl_2.2H_2O$), but they are hazardous to microflora and fauna, damaging of plant crop, difficult to handle. There are several industrial applications for eliminating soil stress in crops, one of them is magnetic water treatment (Ali Y. *et al.*, 2014a).

The Magnetized water have been studied on crops since last 80 to 90 years as it effects seedling stage at the molecular level in germinating plants (Abdelaziz A. and Abdelrazig. M, 2014a). This process aids the plant in proper growth and germination, both qualitatively and quantitatively (Tahir N.A. and Karim H.F. 2010). Hence, increasing its yield and productivity. It enhances the mineral content in seeds, it is environmental friendly (Ali Y. *et al.,* 2014b) procedure and have "memory effect" (do not disappear immediately after its implication). This approach can be easily implemented. The mechanism working behind this industrial technique is the influence of both the natural geomagnetic field and external magnetic field in the plants resulting in the enhancement and alteration of growth and development of seedlings (Jaime A.2014a). Significance of externally applied magnetic field is that, it increases the polarization effect and changes the formation of clustering structure of salts present in it (Jaime A. 2014b).

To check the effect of magnetized water we choose chickpea seeds for our experimental study. Chickpea (Cicer arietinum. L) is an ancient cultivated cereal crop. It is the second most important food legume after dry beans and peas. It is self-pollinating crop, and cross pollination is rare. The chickpea belongs to genus Cicer, family Leguminosae; it comprises of 43 species, 9 of which are annual including chickpea and the rest are perennial. It is salt sensitive crop and a protein rich supplement to cereal based diet (Shanko D. 2017).

## Material and Method

For the recent study, the chickpea seeds were chosen as they are salt sensitive, widely cultivated and had quick germination rate. The seeds were brought from NARC (National Agricultural Research Centre). At first, the dry weight of seeds was taken i.e. 20.1g, then the seeds were soaked for 24 hrs in water to break their dormancy. A pot method with complete randomized block design was applied in kitchen garden of NJC Rabwah, during winter season of 2019. The study was conducted to determine the effect of two different levels of saline water in the podder-9 variety of chickpea seeds in order to check the germination rate of seeds. 8 pots were taken, 4 of which were labelled as controlled (C1, C2) and 4 were labelled as replicates (R1, R2).

In each pot 5 seeds were sown in same textured soil and irrigated with; S1 (EC:2850) and S2 (EC:4830) water treatments. The S1 and S2 water were magnetized by using powerful pair of permanent magnets having opposite polarity tied on both sides of pipe. The magnetized water was given to the seeds on weekly basis. Sample seeds germinated within 15-25 days, after 30 days the seeds were harvested; separated into roots, shoots and leaves. Afterwards these samples were preserved in 10 ml Potassium Phosphate buffer for 24 hrs time period. The preserved samples were ground and centrifuged for upto 15 min at 10,000 rpm. The biochemical tests were performed for these samples and the tests are Ascorbate peroxide test (Asada R and Takashi M. 1987), Hydrogen peroxide (Velikova *et al.*, 2000), Malondialdehyde test (Dhindsa *et al.*, 1981), Total Protein content.

### 1. Total Soluble Protein Test

Barford reagent 10ml, Sample 0.25ml were taken and incubated for 15-20 mins. Then by using spectrophotometer, the total protein content of the samples is checked at 595nm.

### 2. Ascorbate peroxide Activity (APX) Test

Potassium phosphate buffer 100µl, Ascorbic acid 800µl, $H_2O_2$ 300µl, Sample 400µl were taken in cuvette and the absorbance of samples were observed in spectrophotometer at 290nm.

### 3. Hydrogen peroxide Determination Test

Trichloro acetic acid 0.1ml, Iodine potassium iodide 0.1ml, Sample 0.1ml were taken and the content of hydrogen peroxide was determined in spectrophotometer at 390nm.

### 4. Malondialdehyde Content (MDA) Test

Trichloro acetic acid 1ml, Thiobarbuturic acid 2ml, Sample 1ml examined in spectrophotometer at 532nm in order to inspect the malondialdehyde content.

## Results and Discussion

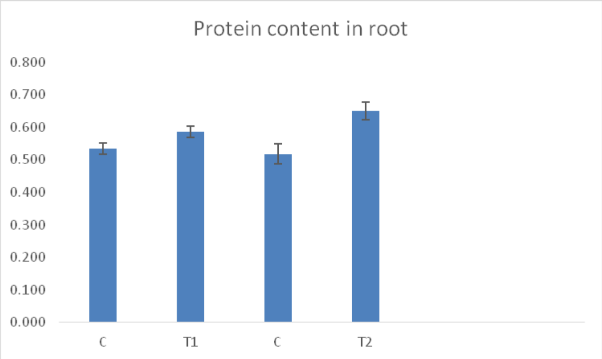


**Fig.1: Protein content in root**

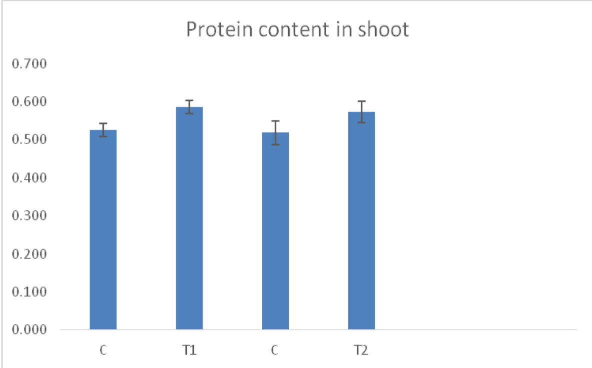


**Fig.2: Protein content in shoot**

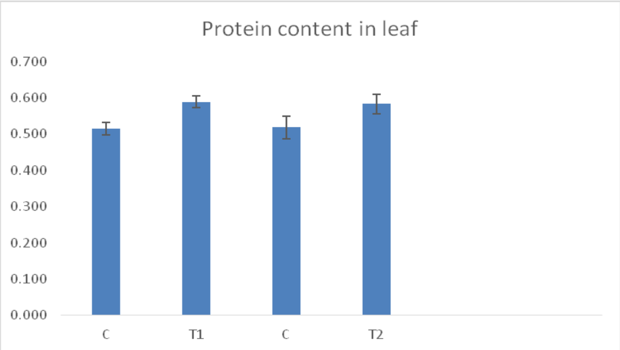


**Fig.3: Protein content in leaf**

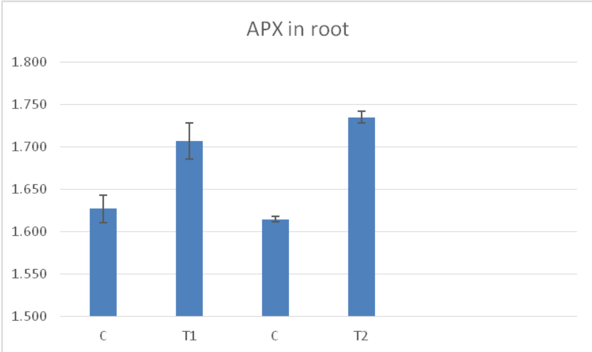


**Fig.4: APX content in root of chickpea plants**

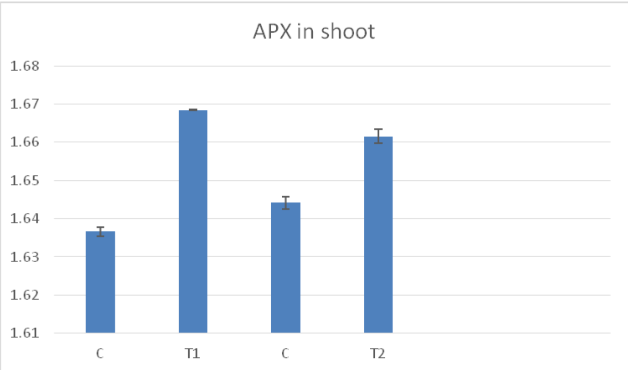


**Fig.5: APX content in shoot of chickpea plants**

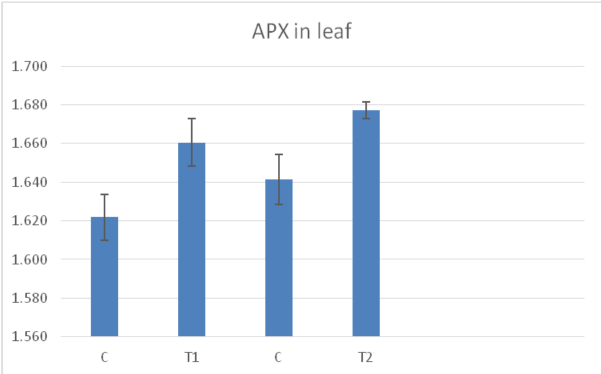


**Fig.6: APX content in leaf of chickpea plants**

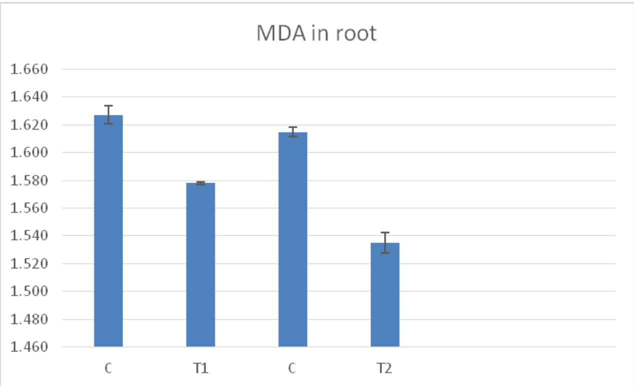


**Fig.7: MDA content in root of chickpea plants**

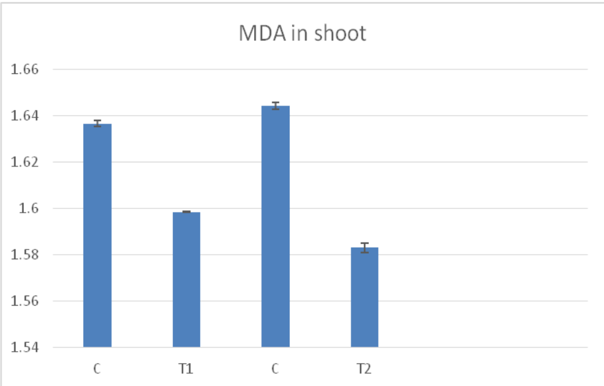


**Fig.8: MDA content in shoot of chickpea plants**

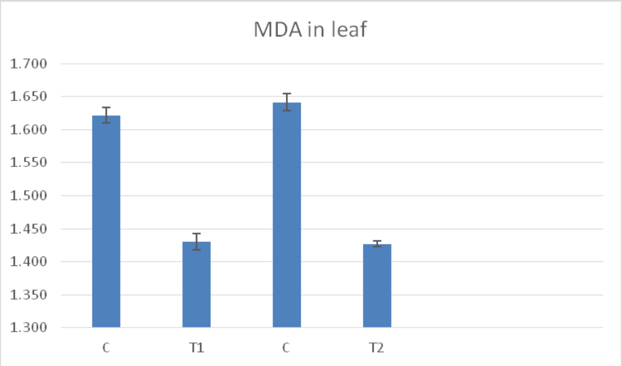


**Fig.9: MDA content in leaf of chickpea plants**

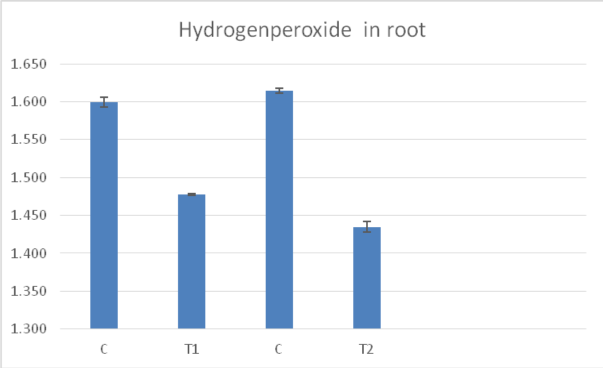


**Fig.10: $H_2O_2$ in root of chickpea plants**

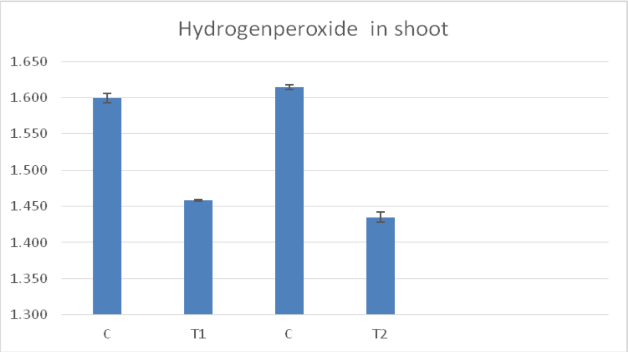


**Fig.11: $H_2O_2$ in root of chickpea plants**

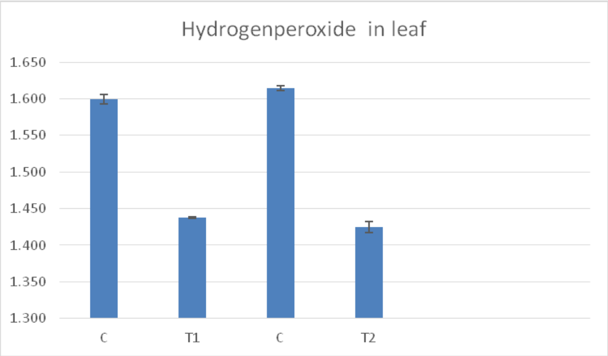


**Fig.12: $H_2O_2$ in root of chickpea plants**

The above graphs show that protein content in root, shoot and leaf has increased in the treatment group as compared to the control group which shows the effectiveness of the magnetic water treatment. The T2 treatment has shown greater result as compared to T1 which is treated with S2 water treatment. In graphs it was observed that S2 water treatment has increased level of salt content that enchantingly modified into forms which are beneficial for plant protein synthesis system.

These graphs on APX content, shows that the root, shoot and leaf of chickpea has increased content of APX and it produced enough of enzymes for scavenging ROS in the treatment group. In APX content graph there is a difference in the root and shoot readings, this is because of the transpirational rate in those parts of the plant i.e. root and shoot. The control group shows minimum APX content which represent that the magnetic water treatment is beneficial for reducing soil salinity.

The Malondialdehyde (MDA) content in treatment group of root, shoot and leaf decreases as seen in the graphs. The MDA content in control group is higher due to saline stress. Thus this result clearly shows that magnetic treatment has reduced MDA content, eliminating salinity effects.

As shown in the above graph, the hydrogen peroxide content is decreased in treatment group of roots, shoot and leaf of chickpea. The hydrogen peroxide is toxic for plant body. In control group the content of hydrogen peroxide increased.

Magnetic water treatment is quiet an effective technique showing positive results in many cereal, legume and other crops. Previous researches have been done on black eyed beans (Deshpande M. 2014a), onions, sunflower, tomatoes (Abdelaziz A. and Abdelrazig. M. 2014b) and sweet pepper seeds (Ahamed M.E.M. 2013) applying magnetic field for enhanced seed and plant growth showed that the usage of magnetized water has a significant role in the plant growth and their proper functioning and mineral uptake. The statistical analysis of the previous findings of researchers working on different crops shows that the magnetic water treatment has a positive impact on the proper growth and development of plants. Recent study was applied on the chickpea showing the similar patterns of significant similarities in growth and development of plant as the previous work.

Study on black eyed beans and chick peas (Deshpande M. 2014b), have shown that the usage of magnetized water for these legumes helped in obtaining high yield and efficient growth which is similar in case of our study as the protein content increased in the germinated chick peas and its growth was enhanced also the increase in APX pointed the overcome of the salt stress in the legumes due to which the growth rate was significantly increased.

## Conclusion

The above study has shown that the magnetic water treatment has significant results on the chickpea replicate plants as compared to control group. The results of biochemical tests have proven that protein and APX content in applied experiment increased while hydrogen peroxide and MDA content in growing seedlings has been declined.

## Acknowledgement

We highly acknowledge the National agricultural research Centre (NARC) for providing us good quality seeds for our research work.

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