The study of magnetic water effect on the total protein content, and the activity of catalase, peroxidase and superoxide dismutase of rice (*Oryza sativa* L.) Var Hashemi

Fatemeh Babaloo*(corresponding author)*, Ahmad majd1, Sedighe Arbabian1, Fariba Sharif niya1, Faeze Ghanati2

1Department of Biology, Faculty of Biological Sience, Naorth Tehran Branch, Islamic Azad University, Tehran, Iran
2Department of plant Science, Faculty of Science, Tarbiat Modarres University, Tehran, Iran

Abstract

Water as a diamagnetic molecule can be affected by magnetic fields; since water is the most important constitutive element of living cells, and all cellular biochemical reactions take place in water, it is assumed that a part of these effects that happen under magnetic field treatment is due to molecular characteristic of water. This study aimed to investigate the effects of magnetic water on total protein content, and the activity of Catalase, Peroxidase and Superoxide dismutase of rice (*Oryza sativa* L.). To this end rice seeds-paddy- were grown in rice fields as two experimental groups. A group of seeds were irrigated with normal water and in parallel the other group with magnetic water. Results revealed that in comparison to control plants, irrigating with magnetic water increases the growth parameters, photosynthetic pigments rates and it activates antioxidant system. Results also showed increase in total protein content and anti-oxidant enzyme which in perse effective in improving the quality of production. finally the magnetic water with intensity 110 mT- and the time taken to work on development and operation of the plants had a positive effects.

Key words: magnetic water, Antioxidant Enzymes, Total protein, *Oryza sativa* L.

INTRODUCTION

Water is the most important factor for plant growth. Attempts to increase food and energy production for satisfying growing needs, led the intensive development of plant production through the use of chemical additives, which in its turn caused more and more pollution of soil, water and air [1]. Irrigation with magnetic water (MW) increases seed germination [16]. The water treated by the magnetic field or pass through a magnetic device called magnetic water, when water is magnetic, some physical and chemical properties changed that may be causing changes in plant characteristics, growth and production. Grewal and Maheshwari [14] showed magnetic treatment of seeds and irrigation had a potential to improve the early seedling growth and nutrient contents of seedlings. Utilization of magnetic water improved quantity and quality of common bean crop. It was detected that the magnetic field stimulated the shoot development and led to the increase of the germination energy and fresh weight, and shoot length of maize [3]. Some beneficial effects of the magnetic treatment of irrigating water for the plant yield and water productivity possibly suggested by Maheshwari and Grewal [18]. The understanding of the stimulating effect requires availability of rich experimental materials [2]. Recently, due to the less harmful influence on the environment; the use of physical methods for plant growth stimulation is getting more popular. Moreover, magnetic water for irrigation is recommended to save irrigating water [20]. According to Hozayn and Qados [15] experiments on wheat, they have suggested that comparing to unmagnified water, MW irrigation has increased some of the growth parameters, quantity, quality and chemical components of the plants. Increase in protein bonds of the plants, number of grains, straw yield , and biological production rate of each plant was detected.
Therefore, the aim of the present article is to study the effects of irrigation with magnetic water on the activity of Catalase Peroxidase and Superoxide dismutase of rice (Oryza sativa L. Var. Hashemi)

**MATERIALS AND METHODS**

**Magnetic water**
To provide magnetic water, magnetic water generating device produced by Iranians technology & research Co. and the power of 110 millitesla field strength was supplied. Rice seed samples were supplied by Gilan Agriculture Jihad Organization. Seed divided into two groups of samples from the control and treated samples were divided. All conditions of cultivation and harvesting, the samples were similar and only watered with tap water samples and control samples were treated with magnetic water. After germination the rice seedlings were moved to the field. Random samples of rice harvested in late July 2015 were collected and transferred to the laboratory of Gilan Biotechnology Research Center for further analysis. Plant organs (leaves) were frozen in liquid nitrogen and were kept in - 80 °C freezer to be used for biochemical analysis. The reaction mixture without enzyme extract was used as controls. All chemical materials were prepared from Merck Company.

**Enzyme Assays**
Total protein content was determined by the Bradford (1976) method. The standard curve was developed using a solution of 0.5 mg ml bovine serum albumin (BSA) and a solution of 0.15 mM NaCl with spectrophotometry at 595 nm. The concentration of protein in the plant extract was calculated as per mg protein per g of fresh tissue [7]

**Peroxidase activity**
Peroxidase activity (POD) was determined using method of Chance and Maehly (1955). Absorption at a wavelength of 470 nm was used. Enzyme activity changes were expressed as per mg protein per minute [9-24].

**Catalase activity**
Catalase activity (CAT) was measured by the method of Cakmak and Horst (1991) using 0.2 g thawed sample in 3 ml of 25 mM sodium phosphate buffer, pH 6.8. Absorption at a wavelength of 240 nm was used. Activities of the absorption changes in fresh weight were expressed as mg protein per minute [8, 6].

**Superoxide dismutase activity**
Superoxide dismutase activity (SOD) was determined using method of Giannopolitis and Ries (1997). Reaction mixture containing 50mM potassium phosphate buffer (pH 7.8), 1.3 µM riboflavin, 0.1 mM EDTA. 13 mM methionine, 63 µM NBT, 0.05 M sodium carbonate (pH 10.2) and enzyme extract, was used. The photoreduction of NBT was measured at 560 nm[13]

**Statistical analysis**
Statistical analyses of data were performed with four independent replicates using Excel and SPSS and significant differences were determined via analysis of variance (ANOVA) and comparisons were tested with T test, P ≤ 0.05.

**RESULTS**
Total protein

The analyses indicate a significant difference in total protein level (p<0.05). Comparing the means show that the higher protein level belonged to MW (0.9315) and the lower mean refers to un magnetic water (UMW) (0.8025).

![Fig 1: The effect of Magnetic water on total protein content of rice leaves.](image)

Peroxidase activity:

The analyses indicate a significant difference in Peroxidase activity (p<0.05). Comparing the means (Fig.2) show that the higher Peroxidase activity level belonged to MW (0.63562) and the lower mean refers to UMW (5.4638).

Catalase activity:

The analyses indicate a significant difference in Catalase activity level (p<0.05). Comparing the means (Fig.3) show that the higher Catalase activity level belonged to MW (1.1590) and the lower mean refers to UMW (0.9459).

Superoxide dismutase activity:

The analyses indicate a significant difference in Superoxide dismutase activity level (p<0.05). Comparing the means (Fig.4) show that the higher Superoxide dismutase activity level belonged to MW (0.1452) and the lower mean refers to UMW (0.1145).
DISCUSSION

In this study magnetic water by 110mT was resulted an increase in anti-oxidant enzymic activity and also total protein. With increase in photosynthesis as a result of irrigation with magnetic water, Oxygen free radicals production was also increased which was a side effect of photosynthetic electron transmission that produces a large portion of active bonds of Oxygen[4].

One of the main mechanism against such a free radicals is disposing them by anti-oxidant enzymes. The main anti oxidant enzyme is SOD which can minimize damages by changing superoxid anions to Oxygen. Increase of SOD can cause higher H₂O₂ Levels and as a result –OH. Disposing and detoxification procedure of produced H₂O₂ can be completed by other antioxidant enzymes such as Catalase and different types of Peroxidases and some other non enzymic compounds like Phenols.[12]

When plants were exposed to stresses, they produce high levels of different types of Oxygen free radicals, and to demolish such chemical components, they are armed with enzymic defense systems like SOD and CAT. The impacts of environmental stresses can be calculated by observing the changes in level of such an anti-oxidant enzyme activities[19]

Different researches proved that the MW will affect the plants cell structure and cause some metabolic changes in cells. It also will influence on growth parameters and some cell functions like wise mRNA gene expression, protein biosynthesis and enzymic activities. And will influence on some of the tissues and organs functions [5] Selim [25] has reported the increase in antioxidant level under the influence of MW in tomato.

Sadeghipour [23] has reported an increase of Catalase, Peroxidase and Superoxide dismutase in Mung Bean treated with MW.

Lin et al [17] has reported an increase in protein amount of wheat leaves treated by MW. Researches has reported that MW will increase protein biosynthesis in Soya[5]

Hozayn et al.[15] and Selim et al [25] both have reported protein level increase caused bye MW in lentil and tomato respectively.

El sayed and El sayed [11], Pintilie et al. [22] and Moussa [21] in separate studied of the effect of magnetic water on the plant have confirmed an increase in antioxidant enzymes.

This study was consistent with the above research achievements.

CONCLUSION

The result of present study conclude that magnetic water prevent oxidant damages via increasing of antioxidant enzymes activity. Due to the lack of information about the main mechanism of magnetic water effects is yet unknown, further studies to are necessary to identify the impact on different parts of the plants.

More studies are needed to understand the mechanisms of MW effects on different tissues and plant organs.

REFERENCES


