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Research Article

THE IMPACT OF MAGNETIZED WATER ON GERMINATION AND SOME GROWTH CHARACTERS OF MAIZE (Zea mays L.)

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ABSTRACT

A pot experiment was carried out to study the effect of magnetized water on the germination and growth of maize. Four treatments of different magnetized water and tap water as a control were used in the experiment in a completely randomized design. Results indicated significant increases in germination, plant height, leaf area, shoot and root fresh and dry weight, chlorophyll content (a, b) and some elements content (N, P, K, Ca and Mg) in treatments irrigated with magnetized water compared with control.

INTRODUCTION

The development of ecological agriculture is the important action to realize the agricultural sustainable development. The world agriculture is shifting from the traditional chemical agriculture to the ecological agriculture, and the main way of the trans-formation is biological engineering and physical agriculture [1]. Modern agricultural of efforts are now in search of an efficient eco-friendly production technology based on physical treatment of seeds and water, and these technologies frequency change the course of some physiological processes to increase vigour and plant development of later stage [2]. One of these technologies is the use of magnetic field as an alternative to the chemical methods of plant treatment for improving the production of crops. Many works have been reported that magnetic fields exert a positive effect on the germination of seeds, plant growth and development and yield of field crops [3]. The aim of this study was to determine the influence of the magnetized water on germination, growth and some yield components of maize.

Materials and Methods

Plant materials

The maize seeds were obtained from local market, all seeds were local cultivars.

Magnetic device

The device used for water treatment was funnel shaped obtained from local agent of (Magnetic Technologies L.L.C. Model No. M. Fla, Dubai, UA.E.).

Seed germination

The seeds of maize with uniform size, without seen defect or insect damage were arranged to five treatments as the following:

1. The first treatment, seeds were irrigated with tap water (the control).
2. The second treatment, seeds were irrigated with magnetized water (once)
3. The third treatment, seeds were irrigated with magnetized water (three times).
4. The fourth treatment, seeds were irrigated with magnetized water (four times).
5. The fifth treatment, seeds were irrigated with magnetized water (six times).

The germination tests were carried out at laboratory conditions. The experiment was conducted as completely randomized design with three replications. Germination tests were performed according to the guidelines issued by the [4]. During the experiment germination seed were counted daily and water was added according to the necessity.

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Pot experiment

The soil used in this experiment was river silt, moderately acid (pH 675), highly permeable.

A pot experiment was set up in plastic pots (27×18cm) and arranged in complete randomized design with three replications. The seeds of maize were sown in each pot, then thinned to two homogenous seedlings. Measured volume (500 ml/pot) of water with or without magnetic treatment was applied in each pot soon after sowing according to the treatments described earlier and then daily during the entire duration of the experiment. The plant heights, number of leaves and leaf area were recorded after 45 days after sowing. The shoot fresh and dry weight, root fresh and dry weights were taken at the end of the experiment. The harvested seedlings were used for determination of chlorophyll content (a, b) and part of the dried shoot were digested and used for determination of N, P, K, Na, Ca, Mg. The data of the experiment were subjected to analysis of variance (ANOVA) according to [5].

RESULTS AND DISCUSSION

Table (1) showed the mean values of the germination percentage of maize plant in the laboratory. It was clear that the germination of seeds was significantly influence by the different magnetic treatments. The highest germination percentage was attained by treatment T_2 (water magnetized once) and the lowest value was recorded by treatment T_1 (the control).

Table 1 Effect of magnetized water on germination, plant height, number of leaves and leaf area of maize.

Treat.	Germin. (%)	Plant height (cm)	Number of leaves	Leaf area (cm^2)
T_1	93.00	61.66	10.16	246.03
T_2	97.00	78.33	11.16	281.56
T_3	95.00	77.83	10.66	282.83
T_4	96.00	78.50	11.00	282.03
T_5	96.00	80.50	10.66	280.25
LSD	0.84	14.02	0.44	31.23

Similar results were obtained by [6] who reported that improvement in germination and seedling emergence of tomatoes, pepper, cucumber and wheat when magnetically treated water was used. [7] observed an increase in germination of *Pinus tropicalis* seeds with magnetically treated water. Also [8] reported that the magnetic fields promoted the germination ratios of bean and wheat seeds. In this connection [9] and [10] reported that magnetic water significantly induces cell metabolism and mitosis of meristematic cells of pea, lentil and flax.

The irrigation with magnetized water exerts some changes in physical and chemical properties of water which induced an increase in absorption of water and nutrients, and as a result there may be an enhancement in transportation of nutrient and consequently an increase in germination rate of maize.

The plant height of maize exhibited a significant increase in all treatments as compared with control (Table 1). The highest value 80.50cm was found in treatment T_5 and the lowest value 61.66cm were obtained by T_1 the control. Similar results were obtained by [11] who showed that exposure of *Zea mays* seeds to magnetic water has a favourable effect on the development of shoot in the early stage. [12] concluded that magnetic field increased the shoot and root regeneration rate and their fresh weight in soybean and paulownia organ cultures. Moreover, [13] reported that increases in plant height seedling weight of maize were noted with magnetized water.

As concerning the number of leaves a significant difference was observed between treatments (Table 1). However, the leaf area exhibited a significant difference between treatments compared with control (Table 1). These results concur with the results of [14] who found an increment in leaf area of okra treated with magnetic field compared to control. This increment in leaf area might be due to increased photosynthetic rates due to greater interception of light [15].

The shoot fresh and dry weight of maize showed a significant difference (P=0.05) as indicated in Table (2).

These results are supported by the results of [11] who reported that an increase of the shoot fresh weight of maize was observed.

Table 2 Effect of magnetized water on shoot and root fresh and dry weight and root length.

Treat.	Shoot fresh weight (g)	Shootdry weight (g)	Root length (cm)	Root fresh weight (g)	Root dry weight (g)
T_1	17.66	10.16	20.00	10.33	4.70
T_2	24.70	15.50	30.43	15.90	7.60
T_3	25.70	15.66	30.86	18.53	10.86
T_4	28.53	15.00	36.30	19.33	8.06
T_5	24.66	14.22	30.50	19.66	9.66
LSD	6.72	1.47	4.47	4.31	2.64

The root length, root fresh and dry weight showed a significant difference (P=0.05) between treatments compared to control. Similar results were reported by [16] who found an increase in shoot and root fresh and dry weight of flax when irrigated with magnetized water.

These results may be attributed to the role of magnetic treatment of water in increasing absorption and assimilation of nutrients consequently increasing plant growth and plant fresh and dry weight.

Table (3) showed an increase in N percentage in treatments as compared to control. A significant increase (P=0.05) in P, K, Ca and Mg was observed when compared with control. Similar results were obtained by [17] who reported that magnetic field increased the concentration of N, K, Ca, Mg, Fe, Mn and Zn of cotton leaves. In this connection, [18] reported that an increase in P content of citrus leaves was observed when used magnetically treated water.

In this respect [19] reported that irrigation of tomato with magnetically treated water increased P and K concentration.

Table 3 Effect of magnetized water on constituents chemical of maize.

Treat.	N %	P ppm	K ppm	Ca	Mg	Chlorophyll (a)	Chlorophyll (b)
T_1	1.69	5.69	2335	0.79	0.37	1.514	2.859
T_2	1.80	7.00	2375	0.96	0.38	1.739	2.985
T_3	1.72	5.90	2635	0.88	1.15	1.871	3.003
T_4	1.76	6.90	3860	1.12	0.58	1.855	2.995
T_5	1.94	6.80	2960	0.84	0.86	1.557	2.966

LSD	0.30	0.94	9.09	0.12	0.15	0.05	0.05

The chlorophyll content (a, b) showed a significant difference (P=0.05) between the different treatment as compared to control. These results are supported by the results of [20] who showed that a significant increase in photosynthetic pigments content of wheat was observed as irrigated with magnetic water. The work of [21] also showed an increase in chlorophyll content in sugar beet (*Beta vulgaris* L.) leaves as irrigated with magnetic water. Moreover, [22] reported that a positive effect of magnetic field on chlorophyll content of the explants was observed. In addition to that [23] reported that an increase in chlorophyll a, b and carotenoids in chick pea plants irrigated with magnetized water was observed as compared to control.

The stimulatory effect of the application of magnetic water on the growth parameter in this study may be attributed to the increase in water properties, which induce increasing absorption and assimilation of nutrients consequently increasing plant growth.

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