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Full Length Research Paper

Effect of magnetic field on seed germination of *Triticum aestivum*

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Influence of exposure rate of the magnetic 50 mT on germination of *Triticum aestivum* (wheat) has been studied in the present work. Seeds were magnetically exposed to static magnetic field strength of 50 mT for different time of exposure: 10, 20 and 30 min, respectively. Results showed that the root parameters namely: root growth and dry weight, radicle growth and dry weight, were influenced significantly due to magnetic exposure rate over control. The variable magnetic field of exposure rate (50 mT/30 min) is a very significant factor in influencing the germination process of wheat seeds when compared with the non-treated seeds. It was observed that root length, length of radicle, dry weight of root and dry weight of radicle increased by 18, 12, 0.52 and 43%, respectively.

Key words: Magnetic field, *Triticum aestivum*, root parameters, germination.

INTRODUCTION

Over the years, the effects of static magnetic field on plant life have been the subject of different research studies. Recently, many authors have reported the effects of static magnetic fields on metabolism and growth of different plant species [Hirota et al., 1999; Penuelas et al., 2004; Subber et al., 2012]. It was found that an increase occurred in chemical reaction of plants under magnetic field effect, and magnetic field had a positive effect on photochemical activity, respiration ratio and enzyme activity [Lebedev et al., 1975; Martinez et al., 2000; Phirke et al., 2000; Carbonall et al., 2002]. Also, magnetic field has started to be applied on plants in addition to tissue culture techniques that are used for growing high economic valued plants faster and generating more products [Atak et al., 2003; Corneanu et al., 1994; Lucchesini et al., 1992; Celestino et al., 2000]. Studies made on various plants have shown that magnetic field was effective on seed germination. It was observed that germination was faster for seeds exposed to the magnetic field than those in the control group, and germination percentage increased [Celestino et al., 2000; Muraji et al., 1998; Chao and Walker, 1967]. The objective of this study is to determine the effect of magnetic field of 50 mT on the growth of the primary root length, radicle length, dry weight of root, and dry weight of radicle in seeds of wheat.

MATERIALS AND METHODS

Plant material

Triticum aestivum are used as the test material subject in this study. They were divided into four groups sprouting with distilled water amid an initial temperature of 25°C for 24 h. After germination, the samples under study were exposed to round permanent magnets of about 50 mT through different time (10, 20 and 30 min). 20 seeds were

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Table 1. The temperature ,humidity ,and illumination conditions in each groups

Item	Exposed 1	Exposed 2	Exposed 3	Control
Position	In the air room	In the air room	In the air room	In the air room
Temperature °C	30±5	30±5	30±5	30±5
Humidity%	38±4	38±4	38±4	38 ±4
Illumination(LUX)	590±4	592±4	601±4	597±4

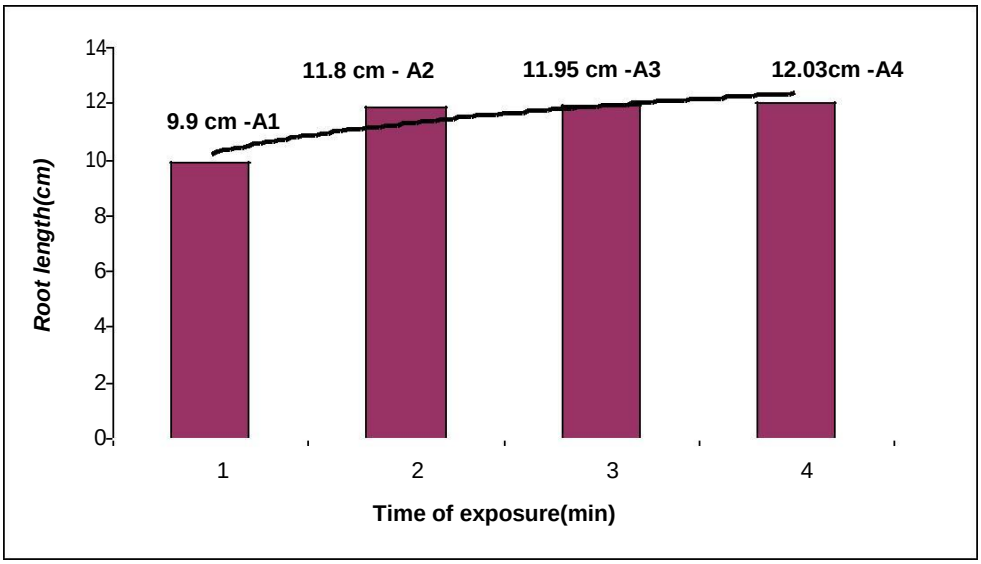

Figure 1. Comparison of the root length under different treatments.

placed in each Petri dish with a watered paper to support the Petri dishes. After water was added, all Petri dishes were allowed to rest for 24 h. The Petri dishes were divided into four experimental groups, each consisting of three Petri dishes. From each group, one Petri dish was chosen as the control. The Petri dishes were marked as follows: the first group was used as the control with A_1, B_1, C_1 and D_1 (reference group); the second group was made up of A_2, A_3, A_4; the third group was made up of B_2, B_3, B_4; the fourth group was made up of C_1, C_2, C_3; and the fifth group was made up of D_2, D_3, D_4. All groups were exposed to 50 mT for different time (10, 20 and 30 min, respectively), except for the reference group. The environmental conditions such as temperature, humidity and illumination of the four groups of wheat seeds were maintained, as shown in Table 1. After two weeks, all groups of seeds were taken out, and the root length and radicle length of each wheat were measured. In order to obtain the dry weight of root and radicle length of root after separation, the dishes were put in an oven at 72°C (equilibrium weight), after which it was subsequently weighed. All data were analyzed by using Compel Random Design (CRD) and it was found that the Less Significant Difference (LSD) of 0.05 was acceptable [Rawi and Kalafalla, 1980].

RESULTS AND DISCUSSION

After two weeks, *T. aestivum* germinated in all Petri dishes but at the first sight, we could observe significant differences. In the control dish, most of the *T. aestivum* germinated but the maximum length root of the young plant was 9.9 cm, and this was found in the reference group (A_1). For the exposed (A_2, A_3 and A_4) group, we found that the length was 11.88, 11.95 and 12.03 cm respectively (Figure 1). One can clearly see that the rate of root length of *T. aestivum* increases by 17, 18.2 and 18.8% for exposed A_2, A_3 and A_4, respectively when compared with control A_1.

In order to investigate the effect of different time of exposure of magnetic felid intensity (50 mT/time) on the growth of the radicle length of *T. aestivum* for each group, sets of groups (B2, B3 and B4) were exposed to different time (10, 20 and 30 min respectively). Figure 2 shows the different values of radicle length of *T. aestivum*. It can be clearly seen that the rate of radicle length of the *T. aestivum* plantlets increases at the dose rate of 50 mT/30

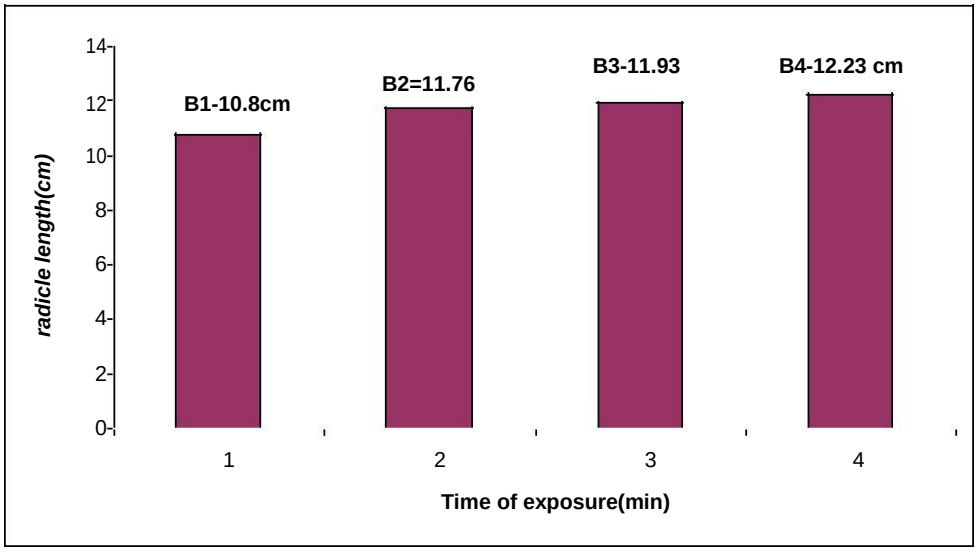

Figure 2. Comparison of redicle length.

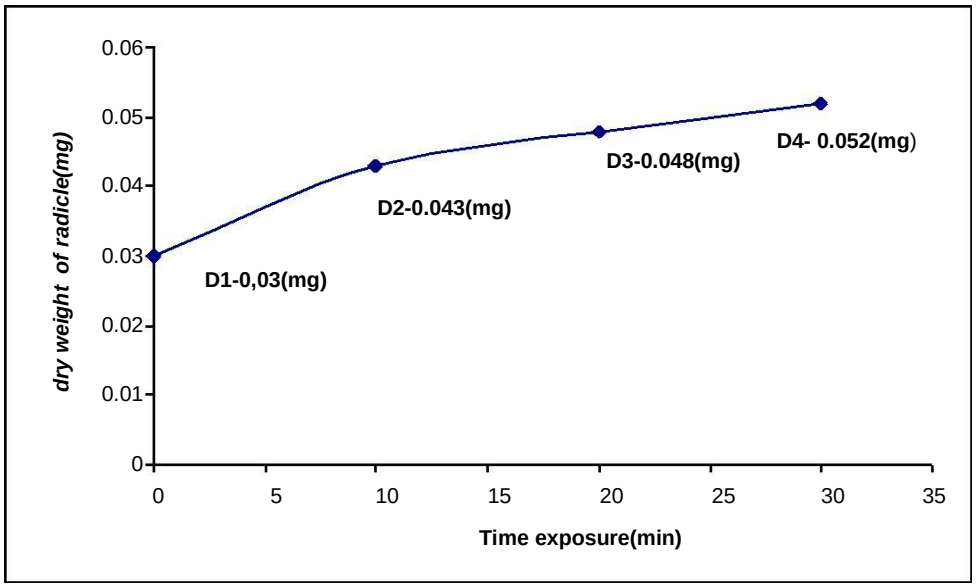

Figure 3. The dry weight of redicle measurements as function of exposure time.

min for group B_4 when compared with control B1 to 12% for exposed B_4 when compared with control B_1. The changes in dry weight of radicle and dry weight of root for groups (C_2, C_3, C_4) (D_2, D_3, D_4) exposed to magnetic field (50 mT) with different time (10, 20, 30 min respectively) in comparison to the control (C_1, D_1) are presented in Figures 3 and 4. It can be clearly seen that the dry weight of radicle and dry weight of root of *T. aestivum* increases by 43 and 52% respectively as compared to control C_1, D_1. Magnetic field treatment of seeds led to acceleration of plants' growth, protein biosynthesis and root development [Hirota et al., 1999; Penuelas et al., 2004]. Also, more accelerated plant growth is believed to be directly due to the reunion of north and south magnetic monopole and the energy that is released with their reunion. The results indicate that different time of exposure of magnetic field intensity (50 mT) has an enhancing effect on the early growth of *T. aestivum*.

Conclusion

The results allow the following conclusions to be

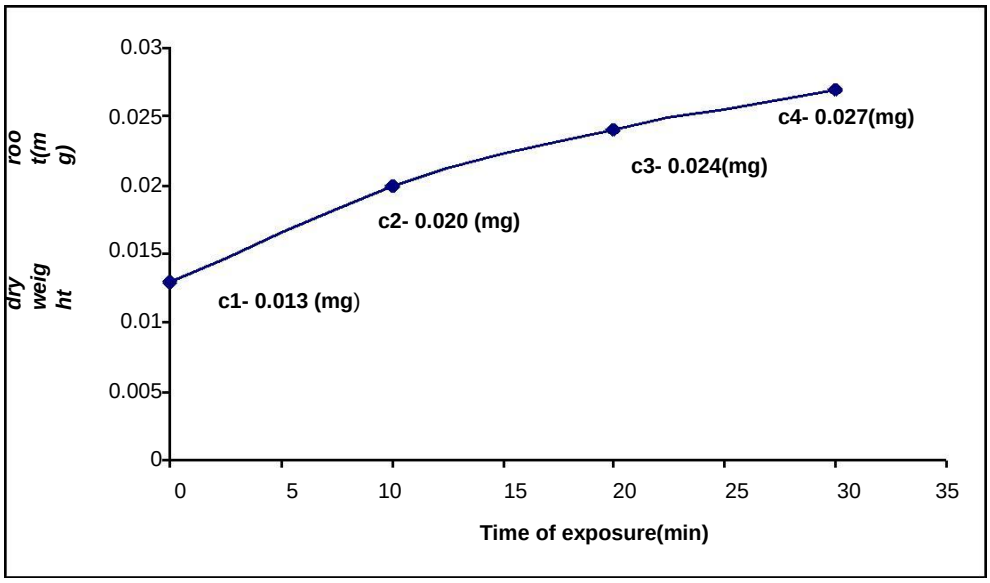

Figure 4. The dry weight of root measurements as function of exposure time.

presented:

1. The rate of root length of *T. aestivum* increases at the dose rate of 50 mT/30 min for each group when compared with the control at 18.8%.

2. The rate of radicle length of *T. aestivum* plantlets increases at the dose rate of 50 mT/0.5 h for each group when compared with the control at 12%.

3. The dry weight of radicle of *T. aestivum* increases at the dose rate of 50 mT/30 min for each group when compared with the control at 43%, but the dry weight of root of *T. aestivum* increases at the dose rate of 50 mT/30 min for each group when compared with the control at 52%.

4. A magnetic field with the dose rate of 50 mT/30 min has the strongest positive effect.

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