



Original Article

Effects of 50 Hz Electromagnetic Fields on Seed Germination and Early Growth in Wheat (*Triticum* spp.)

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ABSTRACT

The effect of short-term (20 and 40 s) exposure of wheat (*triticum*) seeds to extremely low frequency magnetic field (50Hz, 0.5 mT) on seedling growth under controlled laboratory conditions were studied. Fresh weight of seedlings, seedlings height, trying to germinate contents were measured the 4th and 8th day after sowing. Fresh weight was affected by applied treatments in the first days. The results show that the effect of electromagnetic field (0.05mT, 50Hz) on the germination wheat, at 20 and 40 seconds has been respectively increase and then decrease in stem length and weight growth and germination than the control group. It is concluded that application of alternating electromagnetic field of on seed affected seedling growth. Longer exposure time (40 S) has generally induced slightly growth.

Keywords: Extremely low frequency; Magnetic field; germination; wheat.

Received 12.03.2013 Accepted 21.04.2013

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INTRODUCTION

In the past few decades human's natural environment changed because of the brood spectrum and magnetic field (MF) in expanding. Daily applications of the fields in many therapeutic, transports and communication of the industry areas cause the organisms exposed to higher levels of magnetic and electromagnetic fields (EMF) [1-3]. MF and EMF affect endocrine balances in the body via metabolic changes such as glycemic status, weight gain [4-5].

Plants normally grow on land affected by the MF, because the earth act like a magnet ($B=50 \mu\text{T}$) [6].

Over the past 30 years, researchers with the study on changes in alive systems which exposed to magnetic field, with different intensities and exposed period (MF) and EMF even at the lowest frequencies have shown that MF on the different characteristics of plants is influenced, such as root growth, seedling growth and reproduction and growth of plant [7]. Kuzin *et al* [8] reported linear variable magnetic fields because the plants are growing impulse.

Reports have also shown that external magnetic fields have a large impact on activation of Ions and Protection in polarized cells. External magnetic field increases seed germination [9]. Therefore electric and magnetic fields are used as a non-chemical method in farming. This method has a lot of advantages such as environment protection [10]. In this study the effects of electromagnetic fields ($B=0.5\text{mT}$) on seed germination (50Hz) of wheat was studied.

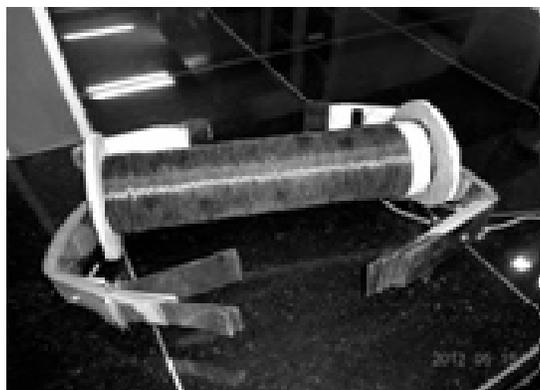
MATERIAL AND METHODS

- Design and Description of EMF emitter set

The EMF producer was designed for produce EMF with 50Hz frequency and ($B=0.5 \text{ mT}$) intensity with using urban electric line adaptor 220v 10A was used for minimizing of heat production by EMF emitter coin (Fig.1).

The EMF emitter set including bobbin (80×10), wires and metal nucleuses was put in the bottom of hatchery machine in a metal lacuna (Fig.1)

Figure1: Image of EMF emitter set with 50Hz frequency and ($B=0.5 \text{ mT}$) intensity



- Seed preparation

Selected seeds for testing have been prepared from laboratory of Islamic Azad University . Before experiment, we washed the seeds with distilled water, and we disinfect with water soluble bleach water Zarl 5% for 10 min seeds are selected in the same shapes, colors and sizes. Approximately, 500 selected seeds were cultured in containers of diameter (8 cm) and high (1.5cm) on cored with wet filter paper to keep the sterile gauze seed. Samples were putted outside the wire tube so that there was distance with the end of wire tube. The effect of edge was eliminated, control group with the same condition but without affecting the magnetic field was considered and measured the time and weight for 8 days. Every day was counted the germinated seeds. The following magnetic pre-treatments were provided:

A₀= reference (control), seeds not affected by artificial EMF

A₂₀= seeds exposed to EMF (0.5 mT. 50 Hz) for 20 seconds

A₄₀= seeds exposed to EMF (0.5 mT. 50 Hz) for 40 seconds

The seed testing separately in completely randomized design with 3 replicates was performed. Experimental analyze and comparison was conducted by SAS Institute, [11]. Mean comparison test was also performed in (p≤0.05).

RESULTS AND DISCUSSION

Eight days after planting seeds into Petri was measure the number of germinated seeds according to this formula

$$\text{Germination percent} = \frac{\text{The total number of germinated}}{\text{The total number of the planted seeds in}} \times 100$$

The intensity of EMF (0.5mT, 50Hz) in 20 second further simulates seed germination of wheat. But with the increasing influence time, this eroticisms a little bit decreases.

On the 4th day the fresh weights of seedlings from both pre-treated groups were significantly different in comparison to the control. The fresh weight of shoots grown from the A₄₀ pre-treated seed (1.49 g) was significantly lower than the same of the control plants (1.63 g) the A₂₀ pre-treatment seeds produced seeding of the highest amount of fresh mass (1.89 g)(table 1).

Those results were not maintained on the d 8, when the total fresh weights were similar for both pre-treated and control plants, and were not significantly different (4.31g, 4.36g, 4.29g for the A₀, A₂₀ and A₄₀ respectively)(table2).

Table 1: Effects of 50 Hz electromagnetic fields on seed germination in 8 d

Day	Treatment	Germination (%)
8 th	A ₀	96.33± 0.35
8 th	A ₂₀	98.67± 0.09
8 th	A ₄₀	97.54± 0.21

Table 2: Effects of 50 Hz electromagnetic fields on fresh weights of seedlings in wheat

day	treatment	Seedling height(mm)	Fresh weight(g)
4th	A ₀	39.8±10.8 ^a	1.63±0.07 ^a
	A ₂₀	41.5±9.5 ^a	1.89±0.10 ^b
	A ₄₀	37.7±10.1 ^a	1.49±0.07 ^c
8th	A ₀	89.7±16.5 ^a	4.31±0.19 ^a
	A ₂₀	91.3±10.2 ^a	4.36±0.17 ^a
	A ₄₀	88.5±13.1 ^a	4.29±0.11 ^a

This work confirmed the existence of strong relationship between pre-treatment exposure time and direction of physiological response of the plant the results obtained in our study are in accordance with [12], where the 10min exposure of group canes to EMF (0.15mT,50Hz) increased the weight and length of shoots, with the two- times longer exposure decreased them.

CONCLUSION

The following conclusions have been obtained:

- An application of alternating magnetic field of (B=0.5mT and f=50Hz) on seed affected seedling growth.

Longer exposure time (40 s) has generally induced slightly growth.

- The resulting differences in fresh weight of seedling were not correlated with the differences in shoot heights,

- In 20 seconds period, the specific electromagnetic field intensity, increased the stimulation of wheat buds and gained germination percentage rather to the control group, but shifting the effective time to 40 seconds, the growth decreased to some extent.

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How to Cite this Article

Faeghi P. and Seyedpour N. (2013). Effects of 50 Hz Electromagnetic Fields on Seed Germination and Early Growth in Wheat (*Triticum* spp.). *Bull. Env. Pharmacol. Life Sci.*, Vol 2 (5): 52-54