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Effects of Magnetic Field on the Growth Development of *Zea mays* Seeds

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ABSTRACT

The effect of magnetic field on the germination of Zea mays seeds has been studied in the present work. Seeds were magnetically exposed to static magnetic field strength of 50mT for different time of exposure, 0.25, 0.5, 1 h, respectively. The goal, is to observe biochemical changes and stimulation effect on the germination of Zea mays plants. The effect of the exposure rate on the root growth, radicle length and protein percentages were discussed and statistic significance analysis was assessed for the differences between the average values of samples and controls. It is found that variable magnetic field exposure time rate (100 mT/hr) is a very significant factor in influencing the germination process of seeds Zea mays in compared with non treated seeds. It is observed, that the root length, radicle length and protein percentage increased by 31.14%, 4.15% and 11.32% respectively.

Key words: magnetic field, *Zea mays*, length root, exposure rate, protein.

INTRODUCTION

Many of us are not aware that magnetism has an effect on the biological objects, until the year 1862, when Louis Pasteur discovered that magnetism affects plant growth when he was experimenting on the fundamentals of fermentation .He found that the earths magnetism affects the growth of the plants. The concept can be effectively utilized in agricultural areas. Studies were conducted for the first time by Savostine 1930 [1], who observed 100% increases in the rate of elongation of Wheat seeding under influence of magnetic field. Since then, many great scientific and experimental works were introduced especially in the agriculture field. Several studies have proved that the effect of static magnetic field on the germination, sprouting and early growth in the plants of different plant seeds [2-7].

Magnetic field treatment of seeds leads to acceleration of plants growth, proteins biosynthesis and root development [8,9].The scientific reports of numerous authors showed that the magnetic field exposure increases germination of non–standard seeds and improves their quality. Also, strong influence on the fast initial growth stage of the plans after the germination is well known [10, 11] compared with those, which have growth out of the magnetic field influence. The present study aimed to assess the effects of magnetic field of 50 mT on the growth of the primary roots length, radicle length and percentage protein in seeds of Zea mays.

MATERIALS AND METHODS

2.1. Exposure System

Thinking about the possible influence of static magnetic field on early growth of plants, we developed the apparatus shown in figure 1. The system consists of an inductor (winding coil), ammeter, voltmeter and power supply. The *Zea mays* growing seeds were under the influence of 50mT magnetic field.

Figure 1. Photograph of exposure system

2.2. Experimental setup

Zea mays variety of Bohooth 106 were used as the test material subject in this study and four groups were sprouting with distilled water with initial temperature 25 ^{o}C through 24 hr, after germination the samples under study, exposed to round permanent magnets of about 50 mT through different exposure times (0.25, 0.5, 1) hr. Five seeds have been placed in each Petri dish and over each, an watered paper support in a Petri dishes. After the water was added all Petri dishes were left for 24 hr. The Petri dishes were divided in four experimental groups, each group consisting of three Petri dishes. From each group one Petri dish was selected as control. We marked the Petri dishes as follows: the first group marked as A_1,B_1,C_1(reference group) , the second group (A_2 A_3 A_4), third group (B_2,B_3,B_4) and fourth group (C_2,C_3,C_4). All groups were exposed to 50 mT for different exposure times (0.25, 0.5,1)hr respectively, except the reference group. The environmental conditions such as temperature, humidity and illumination of four groups of *Zea mays* seeds, are maintained, as shown in Table 1.

Table 1. The temperature, humidity and illumination conditions for each group of seeds

Item	Reference Group	Group 2	Group 3	Group 4
Position	Room atmosphere	Room atmosphere	Room atmosphere	Room atmosphere
Temperature ^{o}C	28 ± 5	28 ± 5	28 ± 5	28 ± 5
Humidity%	46 ± 4	46 ± 4	46 ± 4	46 ± 4
Illumination(LUX)	597 ± 3	599 ± 3	598 ± 3	601 ± 3

After seven days all groups of seeds were taken out, and each *Zea mays* roots length, radicale lengths were measured. All data were analyzed by using the Compel Random Design (CRD) code and it is found that the factor of 0.5 is acceptable [12].

In order to obtain the percentage of the protein in the seeds of *Zea mays* under study, the method of Parsons and Cresser 1979 was used [13].

For each groups of the seeds of *Zea mays* under study 2gm of seeds were dried and grinded very carefully by a Porcelain mortar, the purpose of grinding in this way is to measure the percentage of protein in *Zea mays* by using Italian manufactured Kahldal system. The percentage of protein, was calculated as illustrated in the following equation;

Percentage of Protein = (6.25 N) %

where N is the nitrogen percentage.

RESULTS AND DISCUSSIONS

After seven days the *Zea mays* seeds were germinated in all Petri dishes. In the reference dish most of the seeds have germinated and the maximum root length of the young plant was 11.56cm, and this is the reference group (A_1).For

the exposed A_2 , A_3 and A_4 we found that lengths were 13.8cm ,15.16cm and15.04 respectively. The results are presented in figure 2. One can clearly see that, the rate of root length of *Zea mays* seeds increases by 19,37% ,31,14% ,30,1% for exposed A_2,A_3 ,A_4 respectively compare with control A_1.

In order to investigate the effect different time of exposure of the magnetic felid intensity 50mT on roots growth, radicles growth and the percentage protein of Zea mays for each group. The groups B2,B2,and B3 were exposed to 50mT for times 0.25,0.5,1 hr respectively. Figures 3, represents the different values of Radicle length *of Zea Mays* with respect to exposure time. It can be clearly seen that, the rate length of radicle of *Zea mays* plantlets increases (8.2,12)% for groups B1 and B2 compared with groups B3 and B4. The changes in the protein of *Zea may* seeds for groups(C2,C3,C4) which exposure to magnetic filed (50 mT) with the different time(0.25,0.5,1)respectively comparatively to the control(C1) are presented in figure 4. It can be clearly seen that, the percentage protein of the *Zea mays* seeds increase at the dose rate 50 mT/1hr for groups C2 compare with control C1 with 10%.

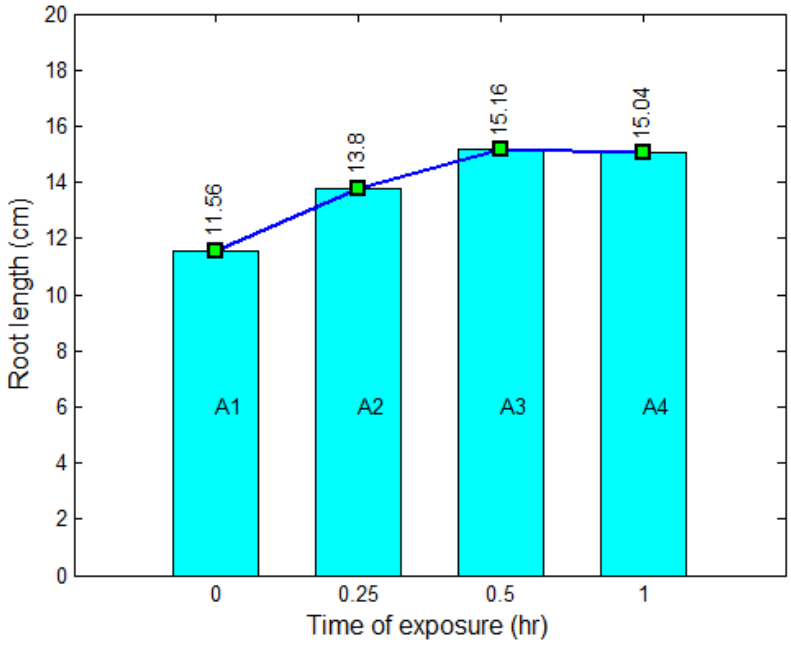

Figure 1. The root length measurements as a function of exposure time.

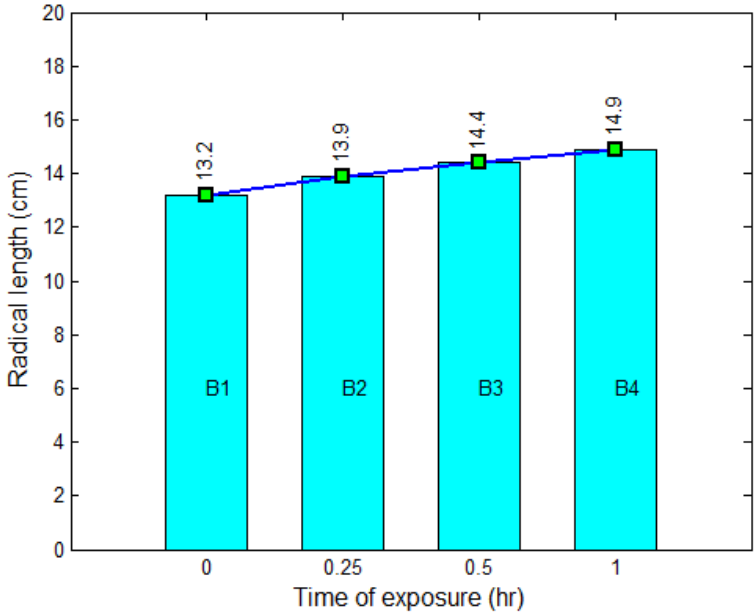

Figure 1. The radical length measurements as a function of exposure time.

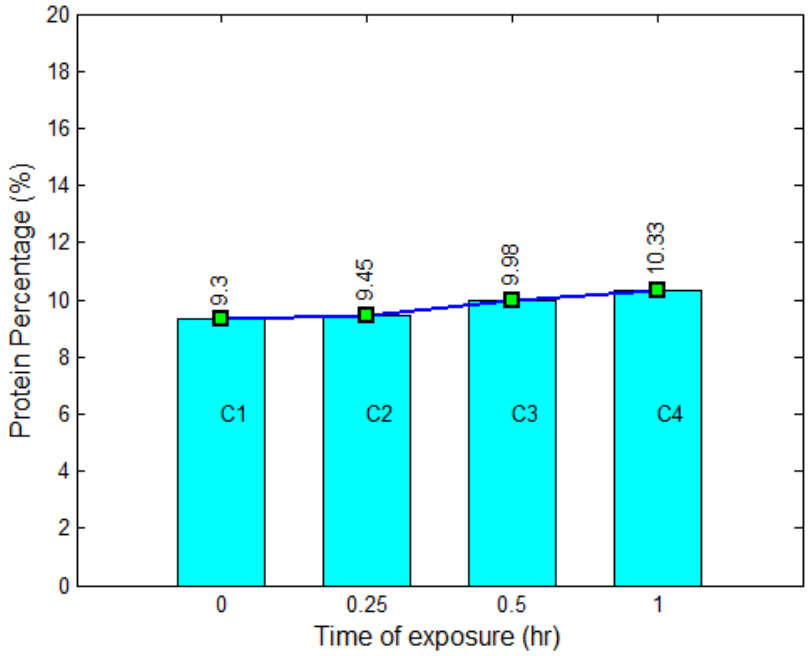

Figure 1. The Protein Percentage measurements as a function of exposure time.

The change in the length of root, radical length and protein percentage of *Zea may* seeds are shown as a slide blue line on the top of the chart in figures 2-4 ,it believed that the rate time of magnetic field exposure have a very high stimulating effect on the motion of ions of plants .Also,it effected on the cell multiplication, growing and development. The metabolic rate was accelerated in the in the exposed seeds compared with non exposed ones, fact proven by the big different achieved in the maturation process. The result indicates that, different time of exposure of magnetic felid intensity (50 mT) has an enhancing effect on the early growth of on the radicle length and the percentage protein of the seed *Zea mays* at exposure rate time (0.5,1) hr.

CONCLUSIONS

In conclusion, magnetic exposure to low static magnetic field 50mT/0.5hr revealed the stimulatory influence on the plants in their early ontogenetic stage: significant enhancement of the root length, 23.75%, and the radicle length, protein percentage increase 7.64%,10% respectively for the dose rate 50mT/1hr. Further research need to be done by exposing the *Zea mays* seeds to different magnetic field strength with constant exposing time.

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