GERMINATION POTENTIAL IN *ALBIZIA LEBBECK* AND *ACACIA NILOTICA* SEEDS AS TREATED WITH MAGNETIC FIELD

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ABSTRACT

Seed germination potential of *Albizia lebbeck* (L.) benth and *Acacia nilotica* (L.) was assessed at Department of Forestry Range Management and Wildlife, University of Agriculture, Faisalabad, Pakistan during 2010. These tree species were treated with magnetic field (MF) of 75mT as pre-sowing seed treatment. Soaked seeds of both plants were exposed to MF of 75mT for zero minute (T_0: Control), 5 minutes (T_1), 10 minutes (T_2) and 15 minutes (T_3) and were planted in polythene bags measuring 10.5 x 12 cm. The bags were irrigated with ground water and monitored for seed germination on daily basis. Seed germination percentage of MF treated was subjected to analysis of variance test. In case of *A. lebbeck,* significantly better seed germination observed in was T_3 (88%) and T_2, (80%) compared to T_1 (55%) and T_0 (44%). Similarly, seeds of *A.* nilotica also showed significantly better seed germination (56%) for T_3 and T_2 (51%) than T_0 (40%) and T_1 (38%). The results clearly suggested that by increasing the time intervals for seed exposure to fixed MF of 75 mT, the planted seeds of both species showed higher germination percentage.

KEYWORDS: ***Albizia lebbeck*; *Acacia nilotica;* magnetic field; seed treatment; germination potential; Pakistan.**

INTRODUCTION

Ecologists believe that all living components are strongly influenced by earth magnetic force (2). The extensive use of advanced chemicals such as growth hormones and salt solutions in agriculture had been a tradition upto the last century. Its unhygienic impacts on the environment were reported by many scientists. So, agricultural scientists took keen interest in the study of plant behaviour as influenced by various pro-ecological factors such as electro magnetic fields, ionizing, laser or ultraviolet radiations, etc. Amazing changes in the plant behaviour, with respect to quantity and quality of yields were noticed, when treated with magnetic field of different magnitude. For

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instance, higher growth rate and enhanced yield were observed in wheat plants when irrigated with magnetic water (20). Therefore, recent researchers focused their attention to explore the influence of such physical factors on plants. They were curious to find out the influences of magnetic field on physiological activities of plants, particularly on germination of seeds and their growth pattern and to correlate the locally produced magnetic fields with physiological changes shown in plants as treated by magnetic field (2, 18, 29).

Development of forestry is pre-requisite for balanced and sustained development and growth in agriculture, industry, education, health and defense etc. Fire wood, timber wood, pulp, paper and paper products and innumerable industrial and railway uses are the urgent needs of Pakistan (26). Pakistan is spending a big share of foreign exchange (Rs. 11,000 millions) to import wood and wood products for meeting ever increasing demands of timber and fuel wood industry (9). So, it is need of the day to get economic and environmental stability by introducing such a new techniques that may be eco-friendly and economically affordable (1, 3).

Studies regarding magnetic field (MF) application as per-sowing seed treatment (PSST), to test the behaviour of non woody plants, have been well documented and proved environment friendly. However, research work on the behaviour of woody vegetation is still in thrust.

Albizia lebbeck is the protein-rich fodder and a palatable species for cattle, buffaloes, goats, camels, sheep etc. It is widely used as a fuel and excellent charcoal (39.6%) is yielded from its wood (20). Its wood is used mainly for construction, furniture, veneer, cabinet work, flooring, agricultural implements, carts, carriages, cane crushers, carvings, boats, oars and oil presses (8). The plant is well reputed to play its role in pharmacology as all parts of it are reported to show anti-cancer properties (16). *Acacia nilotica* is also considered an excellent browse species and is a big source of protein for livestock. Its nutritive value is parallel to alfalfa (12). It is well reputed tree for land reclamation, erosion control, water conservation, reforestation and soil improvement programs, and serves as a good soil cover and green manure. Its wood is hard and heavy which is used for fuel or charcoal (11).

Effect of MF on seed germination percentage:

Seed germination is a critical stage in the life cycle of the plant. High SGP of low quality seeds is desirable character to produce the healthy seedlings that can tolerate the environmental stresses at initial stage of tree establishment (21).

Because of potential use of *A. lebbeck* and *A. nilotica,* the researchers planed the present project as preliminary study to observe seed germination percentage (SGP) in both species in response to application of MF as PSST. Hopefully, the consequent results would suggest some measures to have the desired features of the trees in terms of quality and quantity such as optimization of priming techniques to improve seed germination and seedling vigor and healthy growth of both plants.

MATERIALS AND METHODS

This study was conducted in the Department of Forestry, Range Management and Wildlife, University of Agriculture, Faisalabad, Pakistan during 2010. Well ripened and uniform sized seeds of *A. lebbeck* (kala sirin) and *A. nilotica* (kiker) were obtained from healthy trees in University area. The seeds were cleaned to make them free from debris. Potting medium was prepared with sandy loam soil (taken from the upper 10 cm layer of soil in the forest nursery), made free from plant debris/straw and other deleterious materials, sun dried, grounded and passed through 5 mm sieve. Six polythene bags measuring 10.5 × 12 cm were filled with soil material as per experimental plan and were reserved for raising of experimental plants of each species per treatment per replication. The experiment was planned according to CRD. Total number of plants of each tree species under four treatments with three replications were 72 (number of plants per treatment ×T × R = 6 × 4 × 3 = 72). Where, T stands for number of treatments and R for number of replications.

Seeds of both species were put in hot water and kept in same container for 24 hours to ensure early germination because hard waxy seed coat needs scarification, necessary before planting (23). The pre sowing magnetic treatments were administrated using an electromagnet device (Magnetic Seed Stimulator) consisting of two pairs of energizable, cylindrical, coils, each formed by 4000 turns of 0.42 mm enameled copper wire. Each pair of coils was wound 11 cm apart on an iron bar (dimension 40 × 3.5 cm), (17). The two bars were placed one above the other, their ends were held by metallic supports. The coils were connected in series and fed through a power source of 220 volts connected with variable transformer having approximately the shape of a 50 Hz full wave rectified sinusoidal voltage. When electric current passed through the coils, a non uniform and dynamic magnetic field was generated in the air space between the two bars. The magnetic field was measured with the help of magnetic flux meter (ELWE 8533996, Germany made).

The soaked seeds were taken to the Biomagnetic Lab., Department of Physics, UAF and were grouped into four categories to treat them with MF of 75 mT for time exposure of 5 minutes (T_1), 10 minutes (T_2) and 15 minutes (T_3). Non treated seeds were taken as control (T_0). The seeds were placed in a petri dish (Pyrax Brand) on the pole of electromagnet. The seeds of four groups were embedded in the assigned PBs within no time to avoid the drying of imbibed seeds. Three seeds of each species were put in the assigned PBs. Number of new seedling emerging from the seeds were recorded on daily base till complete germination. SGP was calculated using the following mathematical expression.

$$\text{Seed germination (\%)} = \frac{\text{Total seeds germinated - Seeds not germinated}}{\text{Total number of seeds sown}} \times 100$$

The collected data were subjected to statistical analysis using ANOVA according to prescribed procedure (28). Fisher's LSD tests were performed at 0.05% probability level to compare the means of tested parameter (SGP). Statistic 8.1 package of computer software was used to analyze the data.

RESULTS AND DISCUSSION

Albizzia lebbeck

The data (Fig. 1) revealed that seeds of *A. lebbeck* gained the highest and statistically significant SGP (88 and 80%) and lowest (55%) when treated with MF of 75 mT for 15 minutes (T_3) and 10 minutes (T_2) respectively compared to T_1 which differed non-significantly. Trend of higher SGP in T_3 (88%) to lowest SGP (44%) in T_0 (control is no treatment with MF) was observed in descending order i.e. T_3 (88%) > T_2 (80%) > T_1 (55%) > T_0 (44%) in a regular manner as shown in Fig.1.

Acacia nilotica

Seeds of *A. nilotica* also showed enhanced SGP accordingly, as exposed to fixed MF for different time intervals except. As clear from for T_1 (Fig.1), similar mean values of SGP under T_3 (56%) and T_2 (51%) differed significantly from T_1 (38%) and T_0 (40%) which were also statistically similar. The results clearly suggested that by increasing the time intervals, seeds of *A. nilotica* showed higher SGP. Trend of higher SGP with increasing time intervals of seed exposure to the fixed MF (75 mT) was observed (Fig. 1).

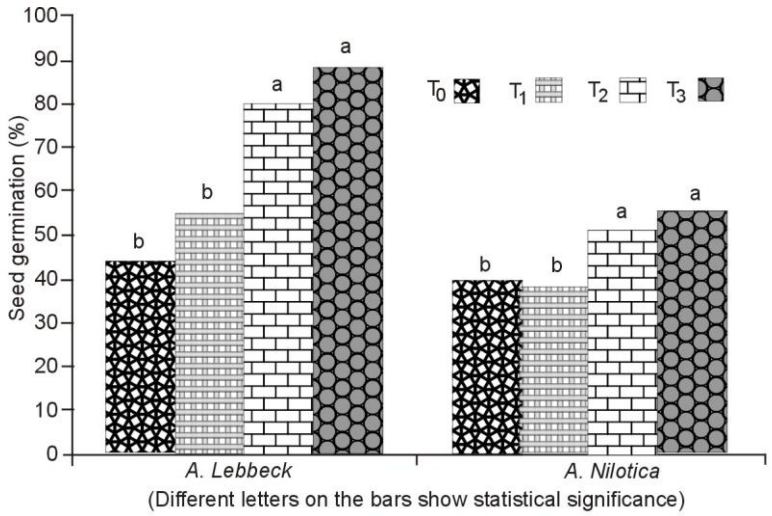

Fig. 1. Influence of magnetic field of 75mT for 5 minutes (T_1), 10 minutes (T_2) and 15 minutes (T_3) on germination perecntage in *A. lebbeck* and *A. nilotica*

Table 1. Assessment of statistical significance among means for seed germination percentage in *A. lebbeck* and *A. nilotica.*

Parameters	Tree species	
	A. lebbeck	***A. nilotica***
*C.V. (%)	11.6	10
**S.E	6	5
LSD	12	10
Seed germination percentage (%)		
T_0	44 ± 6	40 ± 5
T_1	55 ± 6	38 ± 5
T_2	80 ± 6	51 ± 5
T_3	88 ± 6	58 ± 5

*Co-efficient of variance **Standard error.

All the values of SGP in both species were statistically significant (Table 1) which indicate high impact of magnetic treatment on SGP. These results co-inside with the findings of previous researchers. However, previous research work was conducted mostly with herbaceous plants. In present study, seeds of higher woody plants were treated with magnetic flux. These seemed to be less affected by relatively low magnetic field as observed in case of *A. lebbeck* under T_1 and T_0 (Fig.1) which almost similar SGP.

Alexander and Doijode (7) found that onion and rice seeds exposed to a weak electric field for 12 hours showed significant increase in germination,

shoot/root length, and fresh/dry weight of seedlings. PSST of MF resulted in high germination and seedling vigor of low viability rice (13), wheat (3, 15), lettuce (27), barly (24). They pointed out that low-frequency magnetic fields increased the germination rate and percentage of seeds.

Muraji *et al*. (25) observed that magnetic field exerted a positive effect on germination of seeds and produced a bio stimulation of the germination. Arababian *et al.* (10) reported that esterase enzymes in pre-treated seed were increased by magnetic field during germination. The magnetic field treatment on the seeds of various crops and some ornamental and browse tree species increased the germination of non-standard seeds and improved their qualities regarding seed germination rate and seedling growth behaviour (2, 3, 5, 6). Similar results in tomato were reported by De Souza *et al*. (17). Gracia and Arzi (19) also reported enhanced water uptake by lettuce seedlings, when its seeds were treated with MF as PSST.

This explained the reason for increase in the SGGP of treated lettuce seeds. Magnetic field caused many changes in plant behavior showing different seed germination potential, root growth rate, seedlings growth, reproduction and growth of meristem cells and chlorophyll quantities (27).

According to Muraji *et al*. (25), MF stimulated seed germination in various plants. They noticed faster germination than control, when seeds were exposed to MF. Ahmet (2) also used wide range of MF as pre-treatment for seeds to increase seed vigor, seedling growth and yield and reported increased SGP. However, its physiological mechanisms are still poorly understood. He determined optimal range of MF intensities for increasing germination rate, growth and health of lentil and generally finding the effect of magnetic field on plant in different aspects. Celestino *et al.* (14) reported that weak electromagnetic fields (WEF) increased the germination of oak seeds (aka, acorns) and their subsequent growth.

As reported in previous studies many researchers used different intensities of magnetic field for different time intervals, while, here fixed MF of 75 mT as PSST was used. So, it is suggested that such studies may be repeated with soaked and un-soaked seeds by applying magnetic fields of different intensities for relatively larger time intervals. Perhaps, higher plants were found less affected by relatively low magnitude of MF for short intervals, while, herbaceous plants were found more sensitive to low MF for shorter time interval.

CONCLUSIONS

Albizia lebbeck and *Acacia nilotica* were found as the potential plants with enhanced seed SGP when treated with magnetic field as pre sowing seed treatment. However, *A. lebbeck was* found relatively more sensitive as compared to *A. nilotica.*

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