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# Enhancement Of Physical And Biochemical Parameters Of Pithecellobium Dulce Seed By Pre-Sowing Electromagnetic Exposure

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## ABSTRACT

For the development of chemical-free and sustainable agricultural practices to generate germination and growth in plants, pre-sowing electromagnetic treatment was exposed to seeds of Pithecellobium dulce was investigated. Genetically uniform seeds were exposed to the magnetic fields of 500 G for different time induction of 10, 20, 30, and 40 minutes, respectively through an electromagnetic stimulator. The treated and control (non-treated) seeds were sown in separate trays in the same laboratory conditions. Germination percentage (GP), relative root growth (RRG), relative shoot growth (RSG), Germination Index (GI), Vigor index (VI), biomass and Reducing sugar (RS), Total Protein (TP), Amylase Activity (AC), Total Carbohydrates (TC) biochemical parameters were measured by standard methods. There were significant statistical and visual differences noticed among all sets of experiments. Data analyzed that electromagnetically treated seeds gave better results than non-treated seeds. The effective range of electromagnetic treatment for Pithecellobium dulce seed was 500 G for 30 minutes of time induction. Results suggest that the pre-sowing electromagnetic treatment could probably be used to improve the productivity of plants by enhancing germination and seedling growth with a chemical-free, damage-free and sustainable method at the cultivator level.

**KEYWORD:** Electromagnetic exposure, agricultural practices, Pithecellobium dulce seed.

## 1. INTRODUCTION

Pithecellobium Dulce belongs to the family of Fabaceae and a common name in India is Jungle Jalebi. These plant of many uses and have a resourceful protagonist in the traditional system of medicine. Several studies are being carried out concerning the efficacy of the whole plant or its parts for the treatment of distinct illnesses and ailments.[1] Electromagnetic treatment is being used in agriculture, as a non-interfering approach, to enhance the germination of seeds and increase plants and yields.[2] Scientists consider that electromagnetic pre-sowing treatment to improve the property of plant growth and better absorption and assimilation of nutrients by plants.[3] These seeds have a hard seed coat, which causes problems in the germination of seeds because of physical dormancy. Antagonistic effects and temperature are also responsible for uneven and low germination rates and poor crop production [4-8]. Literature shows that methods available for breaking dormancy of seeds are the chemical method, thermal, abrasion, and imbibition method [9-11]. Each method has certain

limitations. The chemical method is costly and gives adverse effects on the environment, thermal and abrasion methods cause damage to seeds in bulk, and imbibed seeds were not possible to store for a long time [12]. The purpose of this study was to determine the effect of 500 G electromagnetic exposure on Pithecellobium Dulce seed for different time induction, covering a complete range of biochemical and physical characteristics such as reducing sugar, total protein, amylase activity, total carbohydrate, plant height, root length, stem diameter, stem radius, germination percentage, as an environmentally friendly method [13].

## 2. METHODS AND MATERIALS

### a. Collection of the seed sample

The seed was collected from the government-authorized shop healthy and a uniform lot of 100 seeds was selected and stored in a dry and sterile place.

### b. Electromagnetic Stimulation

Figure 1 and 2 shows an Electromagnetic simulator that has been used in this experimental work. With this technique, we have treated 100 healthy, uniform, and certified Pithecellobium dulce seeds under 500 G for 10, 20, 30, and 40 minutes, while doing this experiment we have kept the control seeds away from the electromagnetic stimulator.


**Figure 1:** Electromagnetic Stimulator Instrument In Laboratory

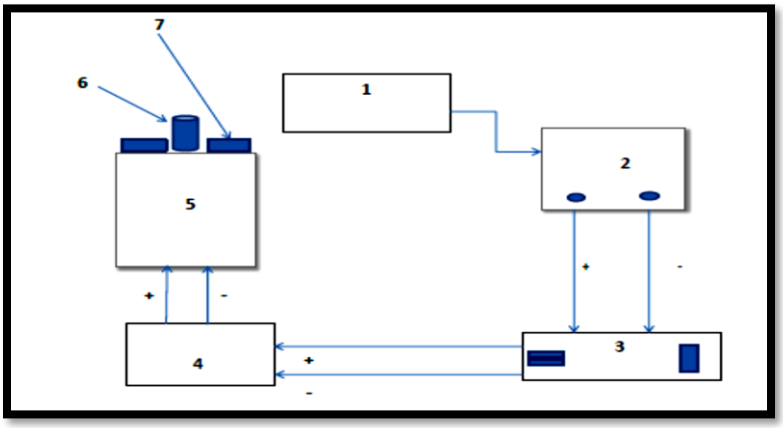

**Figure 2:** Block Diagram Of Magnetic Stimulator

1 current Supply- 230-volt single-phase AC
2 Dimmer sate- Control the current flow
3 Converter- Converts the current AC to DC
4 Ammeter- Measure the current supply
5 Magnetic Field Stimulator- Mug Tech association with variable magnetic strength(1 kG to 10 kG )
6 Sample holder
7 Magnet Bar.

### c. Seed propagation and culture practices

The experiments were carried out in laboratory conditions. The experimental soil pot size taken was 30 cm long, 20 cm in width, and 8 cm in depth. Pots were filled with garden soil up to 5 inches. Row to row and seed to seed distance was 1 to 1.5 inches. Used for germination purposes, seeds were seeded in a pit 1.5-2.5 cm in depth and Irrigated twice a day.

**Figure 3**: Experimental set up of Pithecellobium dulce plants, under the laboratory conditions.

### d. Electromagnetic Exposure Treatment

Seeds were exposed to a magnetic field of 500 G for different time induction of 10, 20, 30, and 40 minutes, respectively through an electromagnetic field stimulator. And control seeds are kept away from the magnetic field stimulator.

### e. Biochemical and Physical Parameter

Table 1 shows the reducing sugar which was measured by the standard DNSA method. These methods detect the free carbonyl group (C=O) of reducing sugars [14]. Total protein content was performed by the standard lowry method [15]. The basic principle behind this is done by the determination of protein concentration which lies in the reactivity of peptide nitrogen with copper ions under an alkaline condition in which the sample color changes. Total carbohydrate content was measured by standard Anthrone assay [16]. These carbohydrates are dehydrated with concentrated $H_2SO_4$ to form furfural to form a green color complex which can be measured in through a colorimeter. The germination parameter was calculated by the standard formula proposed by the International Seed Testing Association (ISTA). Seed viability is 100% detected by a standard tetrazolium test [17].

Percentage of Relative Root Growth (RRG %): It measures the growth efficiency of the plant

$$\text{RRG\%} = \frac{\text{mean root length in the soil}}{\text{mean root length in control}} \times 100$$

Germination index (GI): GI is a synthetic measure designed to reflect the synthesized germination ability including germination rate and germination of seed.

$$GI\ \% = \frac{RSG \times RRG}{100}$$

Vigor Index (VI): To assess the vigor, the length of the root and shoot of each seedling was measured. The Vigor index was calculated using the formula.

Assimilation and intensified photosynthesis collectively enhance seed germination and development. For the first time, in the field of seed science applications of the magnetic field are proposed to break the seed dormancy. Table 1 Shows the speed of germination of Pithecellobium Dulce seed has been reported h

VI = Total seedling length (Root + Shoot) **x** percentage of germination

## 3. OBSERVATION AND RESULTS

Electromagnet actuated physiological and biochemical changes in biological entities [18]. Water higher in seed treated at various magnetic exposure. Bio-chemical plays a significant, role in seed germination and plant growth and adaptation to diverse environment condition.

Table 1: Bio-chemical Parameter of Pithecellobium Dulce Seed

| Characteristics | Reducing Sugar | Amylase Activity | Total Protein | Amylase Activity | Total Carbohydrates |
|---|---|---|---|---|---|
| Units | mg $g^{-1}$ | mg $g^{-1}$ | mg $g^{-1}$ | mg $g^{-1}$ $min^{-1}$ | mg $g^{-1}$ |
| Control | 5.89 | 19.24 | 38.48 | 1.65 | 140.617 |
| 500 G 10 min | 8.77 | 28.08 | 56.17 | 1.09 | 207.019 |
| 500 G 20 min | 7.28 | 24.86 | 49.72 | 1.24 | 190.635 |
| 500 G 30 min | 8.08 | 30.83 | 61.67 | 1.3 | 229.816 |
| 500 G 40 min | 5.33 | 16.97 | 33.94 | 1.36 | 143.617 |

The effect of magnetic treatment was significant for, germination percentage, Relative root growth, Relative shoot growth, Germination index, vigor index shown in Table 3 as compared to control seeds. In this research work, Growth stimulation in Pithecellobium Dulce was observed under 500 G for 30 minutes of exposure indicates appropriate magnetic flux intensity and time induction.

Table 2: Germination Parameter of Pithecellobium Dulce Plant, GP (germination percentage) RRG (relative root growth), RSG (relative shoot growth), GI (germination index), VI (vigor index).

| **Characteristic** | **GP** | **RRG** | **RSG** | **GI** | **VI** |
|---|---|---|---|---|---|
| **Units** | % | % | % | % | % |
| **Control** | 80 | - | - | - | 1260.5 |
| **500 G 10 min** | 70 | 98 | 104.56 | 100 | 1240 |

| | | | | | |
|---|---|---|---|---|---|
| **500 G 20 min** | 79 | 100 | 113.15 | 105.12 | 2240 |
| **500 G 30 min** | 94 | 150 | 109.30 | 147.35 | 2914 |
| **500 G 40 min** | 70 | 130 | 106.92 | 109.92 | 2240 |

The growth rate is considered one of the significant parameter to enhance productivity and in the present investigation, all electromagnetic exposure treatment enhance significantly as compared to control, as it can be seen in Table 3, the plant growth was significantly difference after one week of germination and this difference was distinct at the lateral stage of growth and development. A maximum increase the plant growth was recorded in 500 G for 30 minutes of exposure in compare to control.

Table 3: Physical Parameter of Pithecellobium Dulce Plant

| **Characteristic** | **Seedling Height After1week** | **Plant Height After 2 weeks** | **Steam Diameters** | **Steam Radius** | **Wet Bio-Mass of Plant** | **Dry Bio-mass of Plant** |
|---|---|---|---|---|---|---|
| **Units** | mm | cm | mm | mm | g | g |
| **Control** | 60.4 | 17.14 | 0.017 | 0.008 | 0.198 | 0.146 |
| **500 G 10 min** | 69.3 | 18.3 | 0.027 | 0.013 | 0.223 | 0.173 |
| **500 G 20 min** | 70 | 18.52 | 0.033 | 0.016 | 0.236 | 0.223 |
| **500 G 30 min** | 97 | 23 | 0.037 | 0.018 | 0.294 | 0.248 |
| **500 G 40 min** | 90 | 18.26 | 0.016 | 0.008 | 0.215 | 0.147 |

## 4. DISCUSSION

Exposure to the electromagnetic field in seed triggers germination and growth-stimulating hormones. It influences several nodding pathways and the inherent factor in plant cell outcome of the treatment shows that seeds give an effective result on 500 G 30 min. electromagnetic exposure has a better agreement for based on the above investigation it may be concluded that electromagnetic exposure activates biochemical reaction inside the seeds without making any damage to the seed.

It can be concluded that electromagnetic field exposure technology in seeds may have the potential to give the potential to define a significant improvement in agriculture technology to improve crop germination and productivity in future aspects.

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