https://doi.org/10.48047/AFJBS.6.Si4.2024.4388-4394

African Journal of Biological Sciences

Effect Of Magnetic Treatment OnSeed Germination Of Chick Pea Seeds

Harshad J Trivedi[1*], Dr. Kaushik R. Patel[2] Dr. Vimal S. Joshi[3]

[1*]Department of Physics, D. L. Patel Science College, Himatnagar.Tharshad98@gmail.com
[2]Biogas Research, Shri Mahadev Desai Gramseva Mahavidyalaya, Sadra.
[3]Shri R. K. Parikh Arts and Science College, Petlad

***Corresponding authors**: Harshad J Trivedi
*Department of Physics, D. L. Patel Science College, Himatnagar

Article History
Volume 6, Issue Si4, July 2024
Received: 20 June 2024
Accepted: 5 July 2024
Published: 27 July 2024
doi:
10.48047/AFJBS.6.Si4.2024.4388-4394

Abstract:
Under normal laboratory conditions, the impact of a stationary magnetic field on chick pea seed germination was investigated (NLC). For the periods of fifteen, twenty, and twenty-five minutes, chickpea seeds were subjected to a 1.5 mT magnetic field. Seed germination rate, root length, and length of stem were quantified and observed in a typical laboratory setting. In comparison to NLC, the results showed that chick pea seeds treated with magnetic fields had a significant variation in germination rate, root length, and stem length. The germination rate was higher than the NLC after a 25-minute exposure to a 1.5 m T magnetic field. The lengths of the stem and roots were noted to have increased. Comparing magnetically treated seeds to Normal seeds, significant differences in protein analysis were found.

Key- Words: Magnetic field, Seed Germination, Chickpea

Introduction:

Modern agriculture is looking for advancements in technology that might increase crop output and seedling vigor with only physical seed treatment. Pre-sowing magnetic treatment is a concept where seeds are exposed to a magnetic field before to planting. Some study has indicated possible beneficial impacts on seed germination and plant growth [1]. There are two types of magnetic fields: artificial magnetic fields, which result from the usage of electricity in homes and businesses, and the earth's magnetic field, which generates a natural magnetic field with strength of 0.03 to 0.07 mT [2]. Magnetic fields that change frequently can have both positive and negative effects on plant and animal life. These days, it's a hot topic to determine if magnetic fields affect biological systems in any specific way. This study evaluated the impact of pre-sowing pulsating D.C. magnetic field treatments on wheat seedlings. Physical alterations included variations in the rate of seed germination, the growth of seedlings, and the examination and statistical comparison of root length, branch length, leaf area, biomass, plant growth, and biochemical parameters. It's possible that farmers applied knowledgeable magnetic field treatments on wheat seed germination to boost agricultural yields under a typical weather. Researchers and scientists have been interested in the impact of magnetic fields on seed germination. The potential of magnetic fields in agriculture to improve plant growth and seed germination has been investigated. Because of their high nutritional content, chickpea seeds (Cicer arietinum) are widely grown. Therefore, knowing how magnetic fields affect the germination process of these seeds may have an influence on agricultural operations. The process by which a seed starts to grow into a new plant is known as germination, and it is an important phase in the life cycle of a plant. This process includes the radicle (embryonic root) and shoots emerging from the seed coat as well as the embryo inside the seed becoming activated. A number of important variables control and affect how seeds germinate. Like water, temperature, humidity etc.Some researchers have reported an improvement in some germination parameters of wheat seeds exposure to SMF. Similar positive results of germination seeds have shown for maize [4], sorghum [5-6], Soybean [7-8], Lettuce [9], wheat [10], sunflower [11], lentil [12] and barley [13].

2. Materials and Methods

2.1 Seed Sample:

Excellent chickpea seeds were bought from Devkishanji Vaktaji and Sons in the Gujarat, India, district of Sabarkantha, on Station Road in Himmatnagar. In a typical laboratory setting, these seedlings were subjected to a magnetic field at the D. L. Patel Science College in Himmatnagar, Gujarat, India's Sabarkantha District.

2.2. Magnetic Field Generation:

The purpose of this study is to investigate how a magnetic field affects chick pea seed growth in its early phases. Figure 1 illustrates a setup that included two electromagnets, an ammeter, a voltmeter, and a power supply for treating seeds magnetically. The investigation's seeds were subjected to a 1.5 mT magnetic field for varying amounts of time.

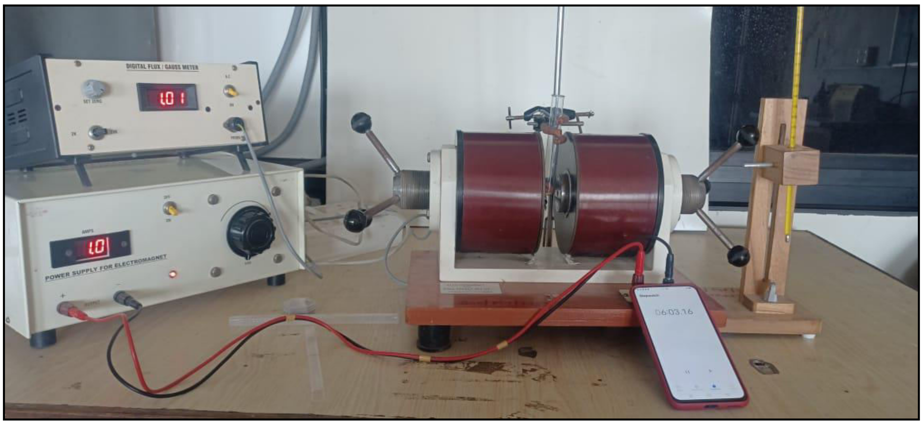

Figure-1: Experimental Set up for magnetic treatment

2.3 Treatment Procedure:

In order to prepare the four groups of chickpea seeds for sprouting, distilled water was added to each group and the temperature was maintained at 28 °C for 24 hours after the seeds germinated. An electromagnet producing a 1.50 mT magnetic field was applied to the samples for several durations (15, 20, 25 minutes). The seeds were divided into three groups according to the length of time they were magnetically treated. There was one control set (non-magnetized) in per group.

The Petri dishes were designated P-1, P-2, P-3, and P-4, respectively, for control (no magnetic treatment), 15 minutes of exposure, 20 minutes of exposure, and 25 minutes of exposure. The environmental conditions that govern and are treated for chickpea seeds are shown in Table 1. After seven days, the morphology of the chick pea seeds in each Petri dish was examined. The same weather conditions were kept for the seedlings that were magnetically treated and the control group.

No.	Item	Control	Treatment
1	Temperature	24°	24°
2	Humidity in %	58% to 62%	58% to 62%
3	Illumination (LUX)	599	599

Table 1:The environmental parameters for the treatment and control seeds, such as temperature, humidity, and illumination.

3. Results and Discussion

For seven days, chickpea seed germination was monitored every other day. Measurements were made on parameters such as protein %, root length, and shoot length. Notable alterations were observed. Here are the results and a discussion of them.

3.1 Root Length:

The measurements of chickpea root length, both as a control and after exposure to a 1.5 mT magnetic field for varied times, are displayed in Table 2. Figure 2 displays these measurements in a graphical format.

Exposure Time	Treatment	Root Length in mm			
		1 Day	3 Days	5 Days	7 Days
Control	P1	4	9	13	15
15 min	P2	3.5	8	12	14
20 min	P3	4.6	11	16	21
25 min	P4	5	13	19	**25**

Table 2: Chickpea seedlings subjected to a 1.5 mT magnetic field measured in root length.

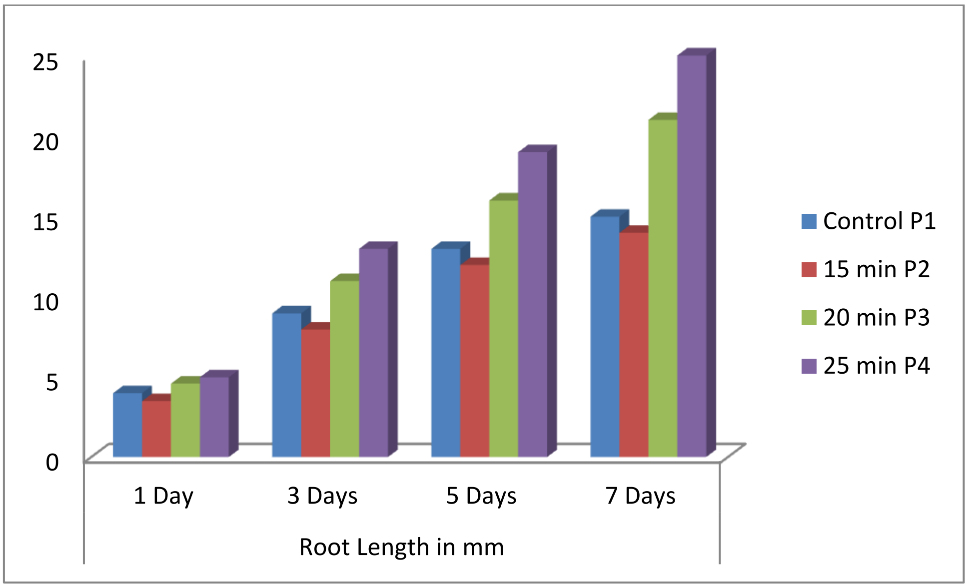

Figure-2: The root length of chickpea seeds is represented graphically at different time intervals.

Following seven days of observation, it is evident from the table and figure above that, when exposed to 1.5 mT magnetic fields, root length increases by 09% in group P2, 16% in group P3, and 26% in group P4 when compared to control P1.

3.2 Shoot Length

Table 3 displays the measurement of chickpea seeds shoot length after they were subjected to a 1.5 mT magnetic field for varied lengths of time as a control. Figure 3 displays the graphical depiction of these measurements.

Exposure Time	Treatment	Shoot Length in mm			
		1 Day	3 Days	5 Days	7 Days
Control	P1	16	23	29	38
15 min	P2	17	26	32	42
20 min	P3	14	26	31	43
25 min	P4	16	29	36	**49**

Table 3: The Shoot length of chickpea seeds exposed to 1.5 mT magnetic field.

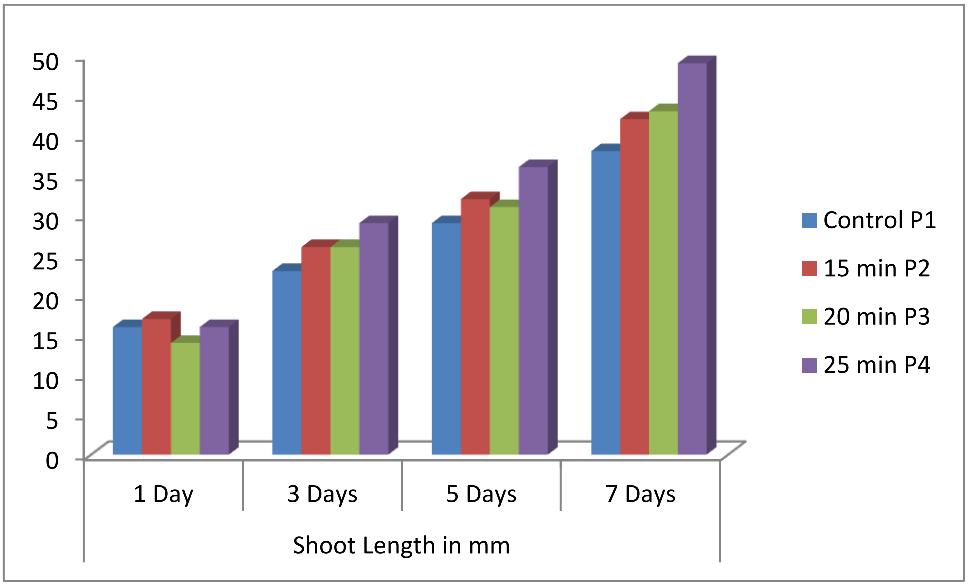

Figure 3: The shoot length of chickpea seeds is represented graphically at different time intervals.

Following a week of observation, it is evident from the accompanying table and figure that, when exposed to a 1.5 mT magnetic field, shoot length grew by 10% in group P2, 21% in group P3, and 28% in group P4 as compared to control P1.The Kjeldahl technique was used to assess the amount of protein in Chick pea seeds. The percentage of protein is calculated using the following equation (1). [18]

Percentage of Protein = [6.25 * N%] (1)

where N is the nitrogen percentage and 6.25 is denoted the protein-nitrogen conversion factor.

Table 4 shows the protein percentage of Check pea Seeds its graphical representation is shown in Figure 4.

		Protein in Percentage (%)	
Min	Treatment	With Water	Without Water
Control	P1	18.3	19.1
15 min	P2	18.6	19.3
20 min	P3	18.8	19.5
25 min	**P4**	**19.1**	**19.9**

Table 4: The Protein Analysis in percentage of Checkpea Seeds with and without water.

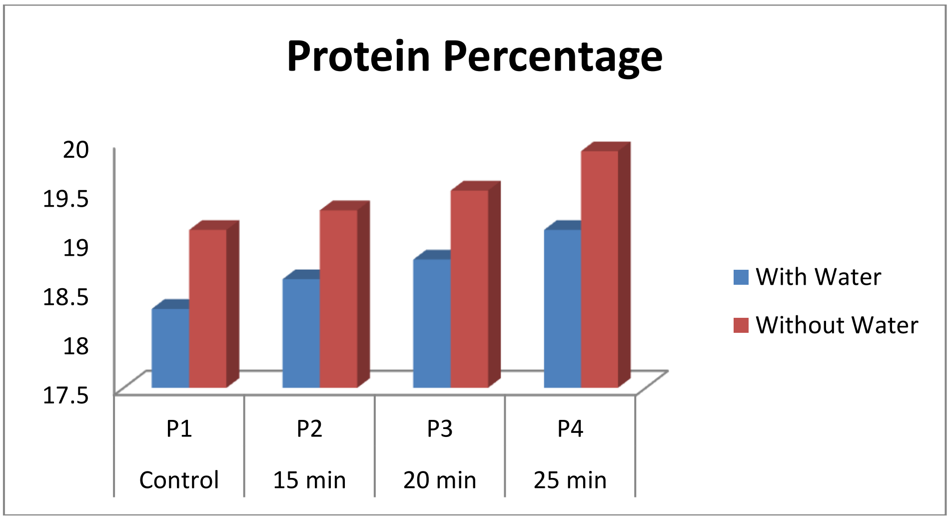

Figure 4: Graphical presentation of Protein Percentage per plant of the control and various Treatment groups.

The mass analysis of Chickpea Seeds for control and magnetically treated plants are shown in Table 5.

		Per Plant Mass in mg	
Min	Treatment	Fresh Mass	Dry Mass
Control	P1	116.2	12.3
15 min	P2	116.3	12.4
20 min	P3	116.3	12.3
25 min	**P4**	**116.5**	**12.6**

Table 5: The Mass Analysis in milligram of Chick pea Seeds.

All of the Petri dishes' chick pea seeds grew after seven days, but right away we noticed some notable variations. The majority of the seeds in the control dish had germinated, yet the young plant's root length in the control (T1) was only as long as 15 mm. We recorded an astounding 14, 21, and 25 mm for T2, T3, and T4, correspondingly, in T2, T3, and T4. Figure shows a schematic of the three test control groups. It is evident that when comparing group T2 to control T1, the root length of the wheat seeds rises by 10% at a dosage rate of 1.5 mT/25 min.
The groupings T2, T3, and T4 were exposed for 15, 20, and 25 minutes, respectively, to examine the impact of varying exposure durations at a constant magnetic field intensity (1.5 mT/time) on the protein % and radicle length development of wheat seeds. The various chick pea seed radicle lengths are depicted in Figure. When comparing groups T2 to control T1, the radicle length of the chick pea seed plant rises at a dosage rate of 1.5 mT/25 min by 26%.
Additionally, we have seen faster plant development, which we believe is connected to the energy released during the reunion of the north and south magnetic dipoles. Other researchers have previously exposed plant seedlings to magnetic fields. The duration of the exposure is the main distinction between our study and the publications we evaluated; we subjected the seedlings to 1.50 mT/time without subjecting them to any additional stress. Longer exposure times to magnetic fields and a temperature stress of 45°C have been used by certain researchers.

4. Conclusions

As a result of this study, the following conclusions are drawn:

1. Magnetically treated seeds show significant growth rate of germination. Exposure time duration plays an important role in this treatment.
2. Root length is increased by 9% in group P2, 16% in group P3 and 26% in group P4 comparison to control P1 for exposure of 1.5 mT magnetic field. The combination of 1.5 mT field intensity for 25 minute exposure gives maximum germination rate.
3. Shoot length is increased by 10% in group P2, 21% in group P3 and 28% in group P4 comparison to control P1 for exposure of 1.5 mT magnetic field. In this case also exposure for 25 minute of 1.5 mT field intensity shows maximum fruitful result.
4. No major impact of treatment observed on protein percentage with water and without water. Negligible differences are observed.
5. No significant effect seen on fresh and dry mass per plant.

Conflict of Interest

The authors declare that they have no Conflict of Interest.

Acknowledgments

The corresponding author is thankful to Petlad Education Trust, Petlad for the reference work and Literature review facilities. One of the authors, would like to thank President, Dr. D. L. Patel, Vishva Mangalam Kelvani Mandal, Himmatnagar for supporting research work at Department of Physics at D. L. Patel Science College, Himmatnagar.

Reference:

1. M.S. Hussain, e. a. (2020). Eco-friendly magnetic field treatment to enhance wheat yield and seed. *Environmental Nanotechnology, Monitoring*, 1-6.

2. Williams, B., A. Ventola and M. Wilson. 2002. 'Magnetic fields and haunting phenomena,a basic primer for paranormal enthusiasts'. Haunting Blog.
3. Peyvandi, M. (2013). The effects of magnetic fields on growth and enzyme activities of Helianthus annuus L. seedlings. *Iranian Journal of Plant Physiology*, 717-724.
4. Vashisth A and Josh D K (2016) Growth characteristics of maize seeds exposed to magnetic field. Bioelectromagn. DOI:10.1002/bem.22023.
5. Nurbaity A, Nuraini A, Agustine E, Solihin M A, Setiawan A and Mbusango A (2019) Enhanced seedling germination and growth of sorghum through pre-sowing seed magnetic field treatment. Earth and Environ. Sci. 393, doi:10.1088/1755-1315/393/1/012101
6. Lazim S K and Nasur A F (2017) the effect of magnetic field and ultraviolet-C radiation on germination and growth seedling of sorghum (Sorghum bicolor L. Moench). J. Agricult. Vet. Sci. 10(10), 30-36. https://doi.org/ 10.9790/2380-1010023036
7. Lewandowska S, Michalak I, Niemczyk K, Detyna J and Bujak H (2019) Influence of the static magnetic field and algal extracton the germination of soybean seeds. Open Chem. 17. https:// doi.org/10.1515/chem-2019-0039.
8. Kataria S Baghel L and Guruprasad K N (2015) Acceleration of germination and early growth characteristics of soybean and maize after pre-treated of seeds with static magnetic field. Int. J. Trop. Agricult. 33(2), 985 -992.
9. Mousavizadeh S M, Sedaghathoor S, Rahimi A and Mohammadi H (2013) Germination parameters and peroxidase activity of Lettuce seed under stationary magnetic field. Int. J. Biosci. 3 (4), 199-207. DOI: 10.12692/ijb/3.4.199-207
10. Sen A and Alikamanoglu S (2016) Interactive effect of static magnetic field and abiotic stressors on growth and biochemical parameters of germinating wheat cultivars. IUFS J. Biol. 75 (1), 19-38.
11. Vashisth A and Nagarajan S (2010) Effect on germination and early growth characteristics in sunflower (Helianthus annuus L.) seeds exposed to static magnetic field. J. Plant Physiol. 167, 149-156.
12. Asgharipour M R and Omrani M R (2011) Effects of Seed Pretreatment By Stationary Magnetic Fields on Germination and early growth of Lentil. Australian J. Basic and Appl. Sci. 5(12), 1650-1654
13. Martinez E, Florez M and Carbonell M (2017) Stimulatory Effect of the Magnetic Treatment on the germination of cereal seeds. Int. J. Environ., Agricult. Biotech. 2, 375-381. https://doi.org/10.22161/ijeab/2.1.47
14. Cresser, S. and Parrsons, JW. 1979. Sulfuric acid digestion of plant material for the determinate in to nitrogen phosphors, Potassium, calcium and magnesium. Anal. Chem. Acta. 1979; 109, 431-6.