

The Effect of Magnetic Field Exposure on The Growth of Green and Red Spinach Plants

^{1*}Qoni' Rodhiyah, ²Ratika Sekar Ajeng. A, ³Ulfa Niswatul Khasanah
Program Studi Fisika, Universitas Nahdlatul Ulama Blitar
E-mail: ¹rodhiyahqoni24@gmail.com, ²ratikasekar@gamil.com,
³ulfaniswatul13@gmail.com

*Corresponding Author

Abstract— A magnetic field is defined as the space around a magnet that is still experiencing a magnetic force. As the electric force, the magnetic force is driven by something, namely a magnetic field. A moving charge creates a magnetic field which in turn exerts a force on another moving charge. This study aims to determine the effect of magnetic fields exposure on the growth of spinach plants. The increase in demand for spinach in Indonesia has not been matched by the availability of sufficient spinach, one of the reasons for the insufficient availability of spinach is the decrease in fertile land for agriculture. This causes the ability to produce spinach planted in the ground also decreases. This study uses materials that are easily obtained, the method used in this research is quantitative research with a true experimental design, in the form of magnetic field exposure on the growth rate of spinach plants. The magnetic field used is produced from the coils of copper wire with the number of 5, 20, 35, 50 and 0 winding, with the duration of exposure was 30 minutes every day for 7 days. Magnetic fields in water exposed where soaking spinach seeds rested which increases the permeability of the seed film, activates calcium ions, and inhibits the growth of microorganisms in water that are harmful to seed germination and plant growth. From the results of this study indicate that the use of copper wire with the number of winding is still not optimally used.

Keywords— Magnetic field; wire coils; spinach

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Corresponding Author:

Qoni' Rodhiyah,
Fisika,
Universitas Nahdlatul Ulama Blitar,
Email: rodhiyahqoni24@gmail.com



I. INTRODUCTION

According to (Batara, 2019), the factors that affect plant growth depend on the frequency of the applied magnetic field, the type of plant that is magnetized, and the duration of magnetization. In the germination process, the magnetic field is able to change the physical and chemical properties of water as a germination medium. Water given exposure to a magnetic field can be absorbed more easily by plant tissues, thereby shortening plant growth and increasing the percentage of germination. Magnetized water is a modern technology that is widely used to help the process of seed germination. By immersing in magnetized water, it is hoped that it will increase the vitality and vigor of the pulled spinach and red spinach seeds optimally. Magnetized water can facilitate the absorption of water into the tissue cavity through the pores passively, especially the absorption of polysaccharide compounds, and can increase the supply of oxygen in the seeds needed to increase enzyme activity, reshuffle food reserves and respiration in seeds (Djoyowasito et al., 2021). The basic objective of this study was to determine the effect of exposure to magnetic fields and duration of exposure on germination, stem height, root length, and the number of leaves of spinach and red spinach variations. In addition, this method can be used as an alternative to shorten the time of plant growth.

II. RESEARCH METHOD

This research uses a quantitative research type with a true experimental design, in the form of exposure to a magnetic field on the growth rate of spinach plants, this research will be used to accelerate the growth of green spinach plants.

The stages in this research begin with a theoretical study and data collection of the necessary tools and materials. Next, determine the value of exposure to the magnetic field that will be given to green spinach plants. This study used a factorial randomized block design with variations of pulled spinach and red spinach seeds. Electromagnetic field exposure was carried out for 7 days with an exposure duration of 30 minutes once a day.

A. Mathematical Formulas

This magnetic field by a current-carrying wire is called magnetic induction, one example of magnetic induction is a solenoid, selonoid is another name for an extended coil.

The formula for magnetic induction the tip of the selenoid:

$$B = \frac{\mu_0 NI}{2l} \dots \dots \dots (2.1)$$

The formula for magnetic induction the center of the solenoid:

$$B = \frac{\mu_0 NI}{l} \dots\dots\dots (2.2)$$

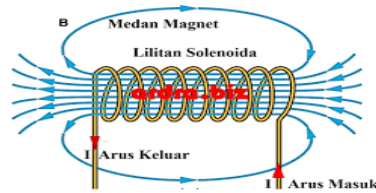


Figure 1 Magnetic Field on Solenoid (Source: ardra.biz)

B. Table

Table 1 Calculation of the average growth of pulled spinach on July 23, 2022

No.	Coil	Magnetic Field Strength (T)	Height (Cm)	Root Length (Cm)	Number of Leaves
1.	0	0	3,72		3
2.	5	75,39	3,83		2,6
3.	20	83,77	4,46		3
4.	35	131,94	3		2,5
5.	50	327,81	3,76		2,3

Table 2 Calculation of the average growth of red spinach on July 23, 2022

No.	Coil	Magnetic Field Strength (T)	Height (Cm)	Root Length (Cm)	Number of Leaves
1.	0	0	3,94		2
2.	5	75,39	4,3		2,5
3.	20	83,77	5,3		3
4.	35	131,94	3,98		2,4
5.	50	327,81	4,9		2,4

Table 3 Calculation of average growth, pulled spinach on July 30, 2022

No.	Coil	Magnetic Field Strength (T)	Height (Cm)	Root Length (Cm)	Number of Leaves
1.	0	0	3,86	3,62	4,4
2.	5	75,39	3,9	1,7	3,25
3.	20	83,77	3,96	2,1	3,4
4.	35	131,94	5	1,66	3,2
5.	50	327,81	3,62	1,7	3,25

Table 4 Calculation of average growth, red spinach on July 30, 2022

No.	Coil	Magnetic Field Strength (T)	Height (Cm)	Root Length (Cm)	Number of Leaves
1.	0	0	4,47	2,55	3
2.	5	75,39	4,6	2,7	2,75
3.	20	83,77	5,86	2,88	4,2
4.	35	131,94	4,84	1,8	3,6
5.	50	327,81	5,08	2,48	3,4

III. RESULT AND DISCUSSION

Based on the observations made by the author, pulled spinach and red spinach planted simultaneously produced pulled spinach and red spinach that grew together within 4 days after planting, this growth resulted in pulled spinach and red spinach with almost the same height and many leaves. Researchers took data on day 10 and day 17 to produce accurate data. This data retrieval is done manually by using a ruler and thread (Astutik & Sudarti, 2021). Measurements were made from the base of the soil surface to the highest leaf, which is naturally upright (Astutik & Sudarti, 2021; Djoyowasito et al., 2021). Besides being influenced by genetic factors, plant height is also influenced by physiological factors and environmental factors.

After doing the measurements manually, the author also carried out the tests carried out in this study using the normality test (Fauzi, 2019), the difference test and the influence test using the PSPP, the results obtained in (appendix 6 and 7). Measurements of pulled spinach and red spinach yielded almost the same data.

The results of the influence of exposure to magnetic fields resulted in growth in coils 5, 20, 35, 50, and without these coils there were plants that grew with different heights, number of leaves and root lengths (Syaifuddin et al., 2016). The number of turns of exposure to the magnetic field is also a determinant of plant growth. Other factors such as climate and pest attack can also occur.

IV. CONCLUSION

Magnetic field exposure is carried out using a DC adapter that is connected to a wire coil on a used milk can in which there are spinach seeds that have been planted. The magnetic field also affects the air in the soil because the magnetic field can break the hydrogen bonds in the groundwater molecules, so that there are more free water molecules, this can lead to an increase in water potential and hydration power and can accelerate the absorption of water by plants.

In general, there is an effect of exposure to magnetic fields on unplugged spinach and red spinach, especially in the number of turns of 20 with $B = 53.33 \times 10^{-6}$ T. Inferential statistical tests the effect of magnetic field exposure applies to all spinach plants. pull out and red spinach.

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