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Effect of Magnetic Field on Germination of Purple Eggplant (*Solanum melongena L*) using Helmholtz Coil

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Abstract

Research has been carried out on the effect of magnetic field on the germination of purple eggplant (*Solanus Melongena L*) using Helmholtz coil. This research aims to determine the effect of exposure to a magnetic field and exposure time on the germination of purple eggplant. The magnetic field displayed is the result of a Helmholtz coil with a diameter of 13.5 cm and 500 turns in each coil with varying current values of 0.18 A, 0.27 A and 0.33 A, and a distance between the coils of 10 cm. This study used 100 samples of purple eggplant seeds, of which 10 samples were controls (0 mT) and 90 samples were exposed to a magnetic field 0,3 mT, 0,4 mT and 0,5 mT which was divided into three exposure treatments, namely 15 minutes/day, 25 minutes/day and 35 minutes/day for 7 days. Based on the data obtained, it is proven that the strength of the magnetic field and the long exposure time have an effect on the growth and increase in the length of purple eggplant seed sprouts. The optimum magnetic field strength and exposure time is 0.4 mT and exposure time is 25 minutes/day. .

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1. INTRODUCTION

Physics is a basic science that is very closely related to human life, not only theory but also losely related to events in everyday life such as the electromagnetic field. The electromagnetic field is a combination of electric field energy and magnetic field energy [1]. Electromagnetic wave radiation has a wide spectrum. The main sources of electromagnetic fields include: generators, power generation, distribution and use; transportation systems, transportation facilities, telecommunications facilities, and various equipment such as telephones, medical equipment, commercial and industrial equipment, radar, radio and television broadcast antennas [2].

In recent years, electromagnetic research reports that focus on the use of magnetic fields to increase plant growth have increased. Several previous studies provide evidence that plants are interesting objects to research and study their biological effects when exposed to a magnetic field [3]. The positive influence of magnetic fields on germination and plant growth and development has been widely carried out and proven by several studies. From this study it was found that magnetic fields can influence germination and seedling growth leguminoceae [4].

Relevant research, Fauziah (2015) has examined that exposure to a magnetic field with variations in time and magnetic field strength (0 mT, 0.5 mT, 1 mT and 1.5 mT) has an influence on the germination growth of majol type date palm seeds with the greatest exposure. effective 1 mT with 3 days of exposure and for the length of date palm sprouts, the most effective magnetic field size is 0.5 mT, the most effective magnetic field exposure is given once every 3 days [5]. According to Sari et al, (2015) the enzyme that plays a role in the plant germination process is the a-amylase enzyme. The greater the magnetic field produced will trigger the rate of movement of the a-amylase enzyme in germination so that metabolism becomes faster [6].

Purple eggplant is one of the commodities that contributes to the diversity of nutritious vegetable ingredients for the population, namely as a source of vitamins, mineral salts, especially Vitamin A and Phosphorus [7]. Eggplant is a type of vegetable that is really liked by many people, because apart from its delicious taste and delicious use as a vegetable ingredient or fresh vegetables [8]. Eggplant has great potential to be developed because of high market demand. Per capita eggplant consumption from 2014 was 2434 kg/capita/year to 2668 kg/capita/year in 2018 [9]. The Central Statistics Agency noted that in 2018, eggplant was also included in 17 (seventeen) types of seasonal vegetables exported by Indonesia with a value of 301,375 tons. The total export value of seasonal vegetables in 2018 reached 1.82 million US $ [10].

To increase eggplant production, this research is necessary to determine the effect of magnetic fields on purple eggplant germination. What magnetic field value can increase purple eggplant germination and what is the optimum magnetic field exposure time.

2. MATERIALS AND METHOD

This research was carried out at the Medical Physics Laboratory, Department of Physics, Faculty of Mathematics and Natural Sciences, Tadulako University, Palu City, Central Sulawesi. The sample used was 100 purple eggplant seeds from the agricultural market. In each treatment which was divided into 4 groups consisting of 30 purple eggplant seeds in each sample, there were 3 treatments providing a magnetic field of 0.3 mT, 0.4 mT and 0.5 mT and 0 mT as a control. Each magnetic field treatment using Helmholtz coil (Figure 1) was carried out in 3 different time variations, 15 minutes, 25 minutes and 35 minutes. The magnetic field was applied every day for 7 days. The medium for purple eggplant seeds is wet cotton. Table 1 shows the conditions of temperature, humidity and light intensity during the research.

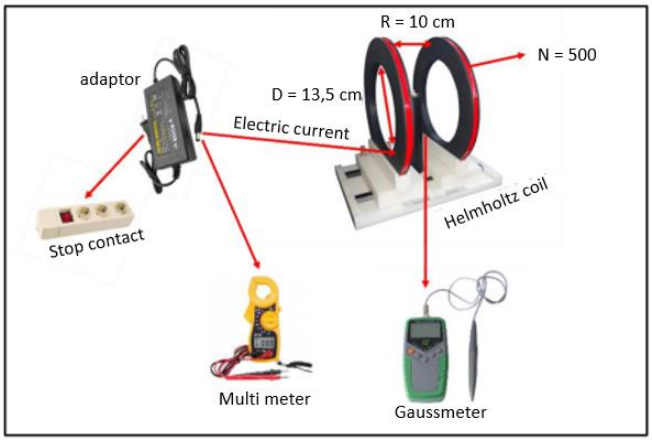

Figure 1. Helmholtz coil circuit

Table 1. Data temperature, humidity and light intensity for 7 days

Day	Temperature	Humidity	Light intensity
1	32.5	50	13
2	26.7	77	10
3	27.3	72	12
4	24.9	93	12
5	28.0	78	13
6	24.9	90	10
7	24.6	94	9

3. RESULTS AND DISCUSSION

The comparison results of measurements and calculations of 3 magnetic field variations can be seen in Figure 2. The direct measurement value has the same magnetic field value as the calculation. Where a current value of 0,18 A produces a magnetic field of 0,3 mT, a current value of 0,27 A produces a magnetic field of 0,4 mT and a current value of 0,33 A produces a magnetic field of 0,5 mT.

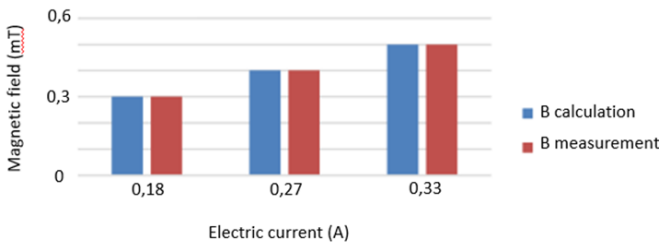

Figure 2. Comparison of magnetic field measurements and calculations

The comparison graph of magnetic field strength and control can be seen in Figure 3 and a comparison graph of exposure time to the magnetic field and control can be seen in Figure 4.

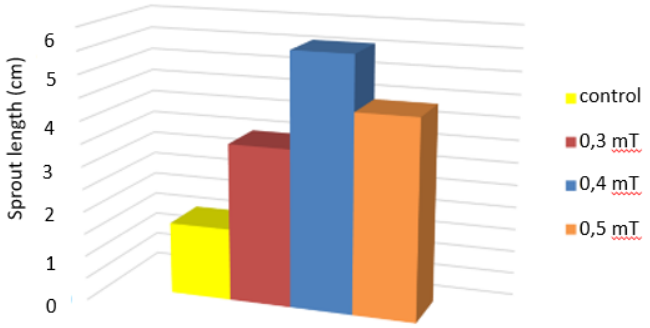

Figure 3. Comparison of magnetic field strength and control

A comparison of the sprouts' length in the control samples and those exposed to the magnetic field in Figure 3 shows the influence of the magnetic field on the growth of purple eggplant sprouts. Exposure to a magnetic field strength of 0.4 mT has a longer sprout length, while magnetic fields of 0.3 mT and 0.5 mT have almost the same length as the length of purple eggplant sprouts. The control sample had the smallest sprout length. The most effective exposure to a magnetic field for the length of purple eggplant seed sprouts is exposure to a magnetic field strength of 0.4 mT. This result is in accordance with Agustrina's research that magnetic fields can increase germination length [4].

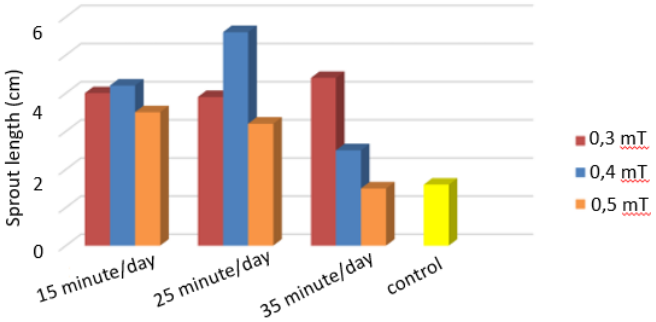

Figure 4. Comparison of exposure time to magnetic field strength and control

The graph in Figure 4 shows a comparison of the length of the sprouts of the control sample which is shorter than the sample exposed to a magnetic field with time variations of 15 minutes/day, 25 minutes/day and 35 minutes/day. The most optimal increase in sprout length is exposure to a magnetic field of 0,4 mT and 25 minutes per day.

4. CONCLUSION

Variations in the strength of magnetic field exposure influence the germination process and increase in length of purple eggplant sprouts. The most effective magnetic field strength is 0,4 mT with the most effective exposure time being 25 minutes/day. Greater magnetic field strength with longer exposure time has a negative effect on purple eggplant seed germination.

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