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Results Of Studies Of Plant Stimulation In A Magnetic Field.

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ABSTRACT

The subject of the research presented in the article were the parameters of the magnetic field, under which it provides the optimal stimulating effect on plants of agricultural (green) crops. Researchers have developed an experimental setup that allows to stimulate plants in a constant magnetic field. It is based on cassettes with cells for growing seedlings, in which radish is planted. For each row of cells, inductors are connected, connected in three batteries, each of which is connected through a rheostat to the power supply. The direction of the turns of the wire in the coils and the electric current in them, determine the magnetic field directed at the center of the coil upward. The experiments were carried out, with one changing factor - the intensity of the magnetic field (1000, 3000 and 5000 A / m), and the remaining factors remained constant. A number of cells with plants without coils were used as a control. During the experiment, in each experiment the length of the plants was controlled and their mean value was determined. It was found that the average length of plants stimulated in a magnetic field was greater than on the control. The greatest average length was observed in plants stimulated by a magnetic field of 3000 A / m and amounted to 152 mm, while the average length of the plants on the control was 106 mm. The difference in length of plants was estimated and the coefficient of variation was calculated. The lowest coefficient of variation was observed at a magnetic field intensity of 3000 and 5000 A / m, and amounted to 12.6 and 11.3%, respectively. Thus, we can confidently state that stimulation in a constant magnetic field increases the intensity of growth and development of plants, and also increases their yield.
Keywords: stimulation, magnetic field, plants, frequency, field strength, magnetic coil, magnetic induction.

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INTRODUCTION

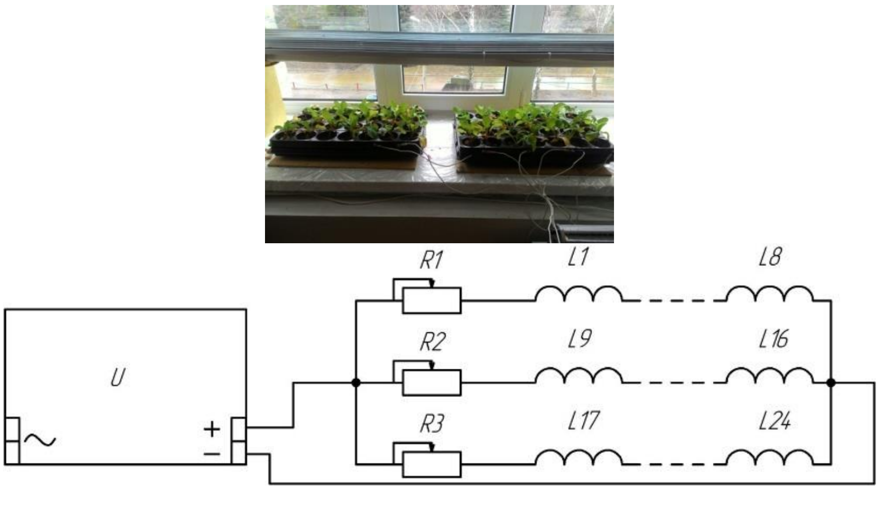
The use of electrophysical technologies in plant growing at the stage of presowing seed preparation for sowing or directly during plant development allows to increase their growth speed and improve their development by replacing traditional technologies that often rely on chemical stimulants and reagents. One of the most promising ecologically safe and technologically effective methods for stimulating plant growth is the treatment of seeds or the effect on the germs by a magnetic field. As a result of this treatment, the growth of plants is accelerated and the product ripens faster: seeds, fruits and tubers [1-12,14-15]. In addition, many plants are planted in the open ground already formed in the form of seedlings. The formation of strong and healthy seedlings of many cultivated crops (cereals, melons, vegetables) also positively responds to the action of the magnetic field, which in the initial period of growth contributes to its better development, thereby laying the prospect of a future quality crop in planned quantities [3,4, 6-8 , 11-12].

The purpose of the research presented in this article is to study the process of increasing the efficiency of growing plants by influencing them with a magnetic field.

MATERIALS AND METHODS

To carry out experimental studies on the effect of permanent magnetic field on plants, an experimental setup based on cassettes with cells for seedlings was developed (Fig. 1, a). The plant consists of two cassettes for seedling with cells filled with soil, as well as mounted electrical equipment, which includes a DC power supply U (Fig. 1, b), three rheostats R1 ... R3, twenty-four inductors L1 ... L24 and electric connecting wires. Inductors are installed on the outside of the cassettes with cells filled with soil and soil. The direction of the turns of the copper wire in the coil and, accordingly, the direction of the electric current in the wires are matched in such a way that the lines of magnetic induction at the center of the coils are directed upwards. Thus, each coil creates a magnetic field, the magnetic flux of which passes up through the cells with plants planted in the ground. Then the magnetic flux dissipates and changes its direction downwards and then converges at the bottom of the cell with the ground, changing its direction upwards. The coils are connected in series by wires to eight pieces, thus forming three batteries. Each battery through the rheostat is connected to the power supply. The rheostats are designed to set the current intensity in the conductors of the coil batteries (Fig. 1, b) [13].

The coils in the batteries are arranged in two rows along the width of the cassette. Two coil batteries are installed on the first cassette in such a way that there are two rows without coils between the batteries, as well as one row with the edge of the cassette. The third battery is installed from one of the edges of the second cassette, with the remaining cells of the second cassette not equipped with coils. In this case, two rows of cells located on the second cassette from the opposite side of the third battery are control [13].



a) b)

Figure 1: Experimental installation of magnetic stimulation of plants: a) general appearance; b) the electrical circuit, which shows: U - power supply; R1 ... R3 - rheostats; L1 ... L24 - coils of inductance

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During the experiment, four experiments were performed, in which one variable factor-the intensity of the magnetic field in the coils-varied. During the experiments it was equal to 1000 A / m, 3000 A / m, 5000 A / m. As a control group, plants not subjected to magnetic stimulation were studied.

Stimulation of plants was carried out daily at the same time from the time of emergence. The stimulation time was one hour a day. To ensure the specified processing time, the power supply unit is connected to the network via a timer.

Norms of illumination, temperature and watering were maintained the same for all experiments.

Studies on the effect of magnetic field on plants were conducted on the radish of the early ripening variety "Alyoshka F1", produced by AELITA.

During the experiment, the lengths of the green and root parts of the plants were measured. The measurements were carried out using a ruler.

RESULTS AND DISCUSSION

To analyze the effect of magnetic stimulation of radish plants, the results of studies of the change in the length of the green part of the radish, under the influence of the magnetic field of the coils of inductance, were used.

In each experiment, their mean length of the studied plants was determined, the results of the measurements are shown in the table. Analysis of the results shows that the average length of the plants that were stimulated by the magnetic field turned out to be higher than on the control. In this case, the greatest average length is observed in plants stimulated by a magnetic field with a strength of 3000 A / m. It was 152 mm, while the average length of the plants on the control was 106 mm.

Table 1: Results of the study of the length of radish plants after seed stimulation by a magnetic field and on the control

Value of the magnetic field strength, A / m	Length of green part of plants, mm								Average value, mm
1000	129	101	132	178	109	137	131	116	129
3000	145	165	127	185	143	151	117	152	152
5000	127	145	125	130	156	165	155	163	146
Control	115	91	115	109	85	105	121	109	106

The dependence of the average length of plants on the intensity of the influencing magnetic field is presented in the form of a graph (Fig. 2).

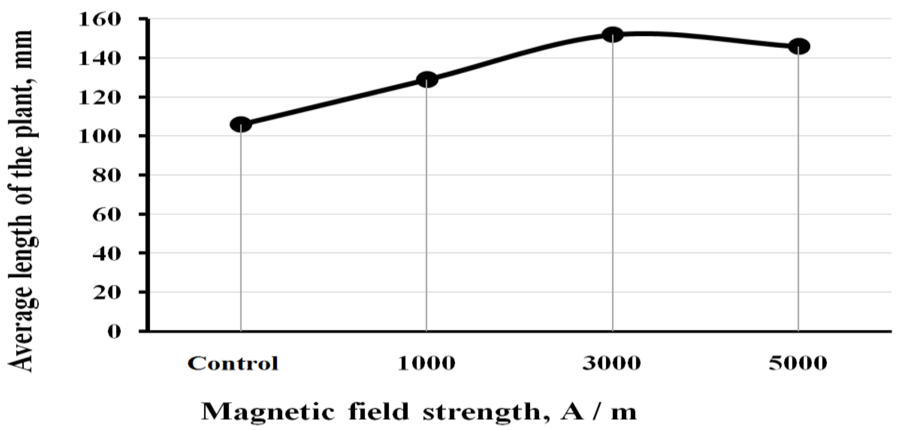

Figure 2: Dependence of the length of the green part of the plant on the acting magnetic field

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Also, the difference in length of plants in each experiment was estimated and the coefficient of variation for each value of the variable factor was calculated. As a result of calculations it was determined that with a magnetic field strength of 1000 A / m, the coefficient of variation was 18.6%, with a tension of 3000 A / m - 12.6%, with a tension of 5000 A / m - 11.3%, and control - 13.2%.

Thus, the smallest variation coefficients are observed at a tension of 5000 A / m and 3000 A / m, which is slightly lower than at the control.

Also, outside the main research program, a study was made of the length of plants that were planted in cassette cells located in the immediate vicinity of cells with coils. The plants in these cells were also affected by the magnetic field, from the side of the coils of the inductance. In this case, the direction of the lines of magnetic induction, in this case was directed downwards.

The analysis showed that the average growth of plants planted in the cells in close proximity to the batteries of inductance coils was also higher than in the control by 23%.

CONCLUSION

Thus, based on research and analysis of their results, it was found that the process of plant stimulation in a constant magnetic field has a certain positive effect associated with an increase in the intensity and growth rate of plants. This positive moment of magnetic stimulation can be recommended for practical application in industrial seedling cultivation. In addition, it can be argued that the use of a permanent magnetic field when stimulating seedlings will increase the efficiency of growing adult plants and increase the harvested crop from them.

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