Study of the magnetic field of a magnetic treatment device for agricultural materials

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SUMMARY: *The type of supply voltage of the coil to achieve maximum induction and uniformity of the magnetic field in the magnetic chamber, where the processed material is determinate. The experimentally obtained dependence curves B = f (U) can be used to optimize the regime parameters when processing various agricultural materials in a magnetic field.*

KEYWORDS: *MAGNETIC TREATMENT, MAGNETIC INDUCTION, MAGNETIC FIELD, SEEDS, PLANTS*

Biophysical methods for stimulating seeds and plants increase their energy balance through the internal transformation of energy (regardless of its origin) into electrical, and hence the electrical potential of the cell membrane. As a result, metabolism and growth (maturation) increases, which leads to increased yields. [4.5.]

The effect of electromagnetic fields on seeds has a biological stimulation of plants. The results of the experiments show that it is possible to increase the yield of cereals by up to 20%, increase the root mass of sugar beet by an average of 39% and its leaf mass by up to 25% by stimulation in a magnetic field. Impact with electromagnetic fields of different intensities in macro experiments with potatoes has led to an increase in yield by an average of about 23.2%, germination energy of seeds is preserved longer, plants grow faster and show higher resistance to disease, accelerating maturation, preserving the quality of products for a long-time during storage, etc. [1.3.]

OBJECT AND PURPOSE OF THE RESEARCH

A device for processing agricultural products with a magnetic field has been developed, Fig.1. The device works as follows. The material to be processed is placed in the magnetic chamber located on the lower pole piece. A stirring mechanism is driven by a gear motor, which mixes the processed material. The exposure time is determined by the type of material being processed. Simultaneously with starting the engine, the coil, which creates the magnetic field, is powered. A magnetic field with a certain value of magnetic induction is created in the air gap in which the magnetic chamber with the processed material is located. After the set processing time has elapsed, the motor and coil supply are switched off. The container is emptied and refilled with raw material. In [2] were identified some of the main design parameters of the device, in terms of the type of magnetic chamber, the drive and the type of the stirring mechanism to create homogeneity of the material during processing. When exposed to a magnetic field on agricultural products are affected not only the design parameters of the device, but also the mode parameters of processing: value of magnetic induction, exposure, type and distribution of the magnetic field.

The aim of the present study is to establish the dependence of the magnetic induction on the values and type of supply voltage of the coil, as well as the distribution of the magnetic field in the area of the processed material.

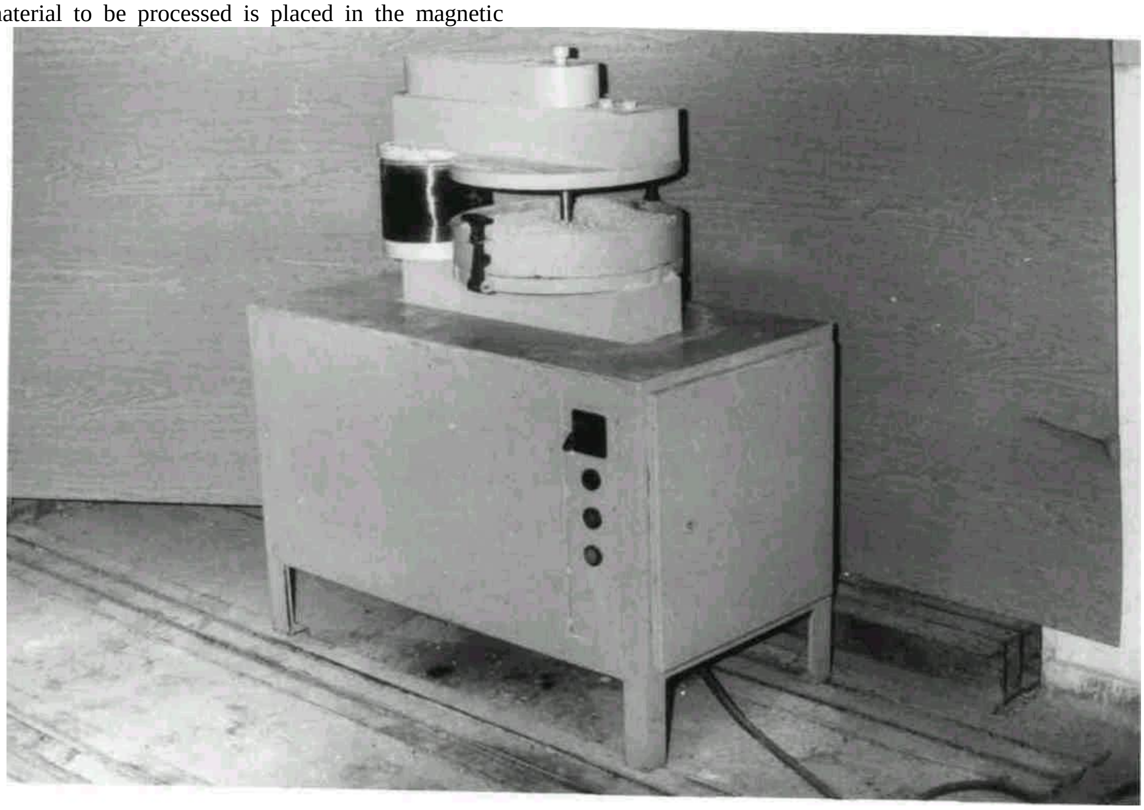

Fig. 1. *Device for processing agricultural materials with magnetic field*

METHODS AND MEANS

To establish the dependence of the magnetic induction on the type and values of the supply voltage of the coil, experimental studies were performed in which the coil was supplied with alternating sinusoidal voltage 0-250 V, 50 Hz with a variation step of 10 V; constant voltage - 12 V; 24 V; 36 V and 48 V, single-phase one-and-a-half-cycle circuit; DC voltage, single-phase bridge circuit "Gretz". The supply voltage in the last two variants is changed from 0-250 V in steps of 10 V. The voltage is regulated by means of an autotransformer. The measurement of the magnetic induction takes place at a pre-selected point on the lower pole piece, where the processed material is placed.

To determine the distribution of the magnetic field, the induction of the magnetic field on the lower pole piece, which has a diameter of 400 mm, was measured. The measurement of the magnetic induction starts from the centre of the nozzle (radius R = 0) at equal distances in two diametrical directions, located at 90 degrees to each other up to a radius of R = 200 mm. The measurement was performed with a teslameter.

RESULTS OF THE SURVEY

When supplying the coil with DC voltage (0-250V, 50 Hz) the measured magnetic induction in the area of the lower pole piece is very small 1.10-5 - 5.10-5T. This is due to the large distance between the two pole tips h = 0-70 mm. At h = 0 the measured induction is B = 1.10-3T. As the height *h* increases, the magnetic induction *B* decreases at h = 70 mm - the induction is B = 1.10-4 T. In the existing design of the magnetic system, the distance between the pole pieces is fixed by the geometric dimensions of the coil, h = 200 mm. At a later stage of device improvement, this distance can be optimized.

Four 12 V rechargeable batteries were used to supply the coil with constant voltage, through the series connection of which voltages of 12 V, 24 V, 36 V and 48 V were obtained. The measured magnetic induction was 0.03T, 0.047T, 0.062T and 0.076T, respectively. The application of this type of power supply, in the study, is hampered by the possibility of using a source of constant voltage up to 250 V.

The obtained results from the measurement of the magnetic induction when supplying the coil with direct voltage, single-phase one-half-cycle circuit and supply with direct voltage, single-phase bridge circuit are processed and based on them the dependence curves of magnetic induction B = f (U) are constructed. The curves are shown in Fig.2. From the type of curves obtained, it can be found that the values of magnetic field induction when fed with a one-and-a-half-cycle rectification circuit are significantly lower than when the coil is supplied with a bridge rectification circuit. In the electrical circuit of the developed device for magnetic processing the coil will be supplied by a bridge circuit "Gretz" for voltage rectification.

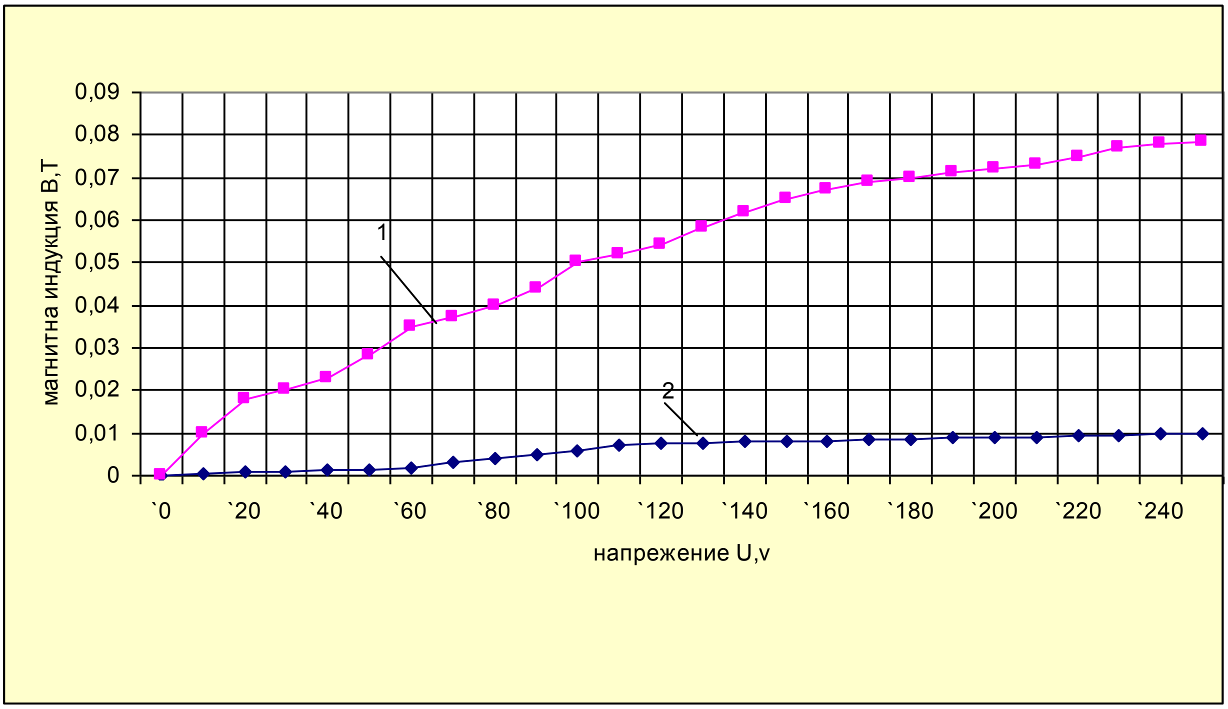

Fig. 2. *Dependence of the induction of the magnetic field B on the supply voltage of the coil U: 1- single-phase bridge circuit; 2 - single-phase one-and-a-half-cycle circuit*

The recommended values of magnetic induction in pre-sowing treatment of seeds from different crops, as well as other agricultural materials are unknown., whether have been determined experimentally or analytically by “Gretz”.

When processing agricultural materials with magnetic field, using the obtained dependence curve B = f (U), it will be possible to realize variants with different magnetic induction of the field between the two pole tips of the magnetic system of the device. This will allow to optimize the regime parameters when processing different agricultural materials with magnetic field.

When studying the distribution of the magnetic field in the area of the processed material, the coil is supplied with a direct voltage of 220 V by means of a bridge circuit "Gretz". The measured values of the magnetic induction *B*, according to the procedure described above, in six radial directions, located at 60 degrees to each other, are the same - B = 0.075T.

The following experiment was performed to illustrate the distribution of the magnetic field. An even layer of ferromagnetic powder is placed on the lower pole piece, where the processed material is placed, fig.3. After switching on the magnetic processing device, the ferromagnetic powder is magnetized in the direction of the magnetic field lines, Fig.4. The relatively uniform distribution of ferromagnetic particles in the magnetic field between the two pole pieces can be seen.

Fig. 3 *Ferromagnetic powder before treatment with magnetic field*

Fig. 4. *Ferromagnetic powder after treatment with magnetic field*

Based on the results obtained from the measurement of the magnetic induction and the magnetization of the ferromagnetic dust, it can be assumed that a relatively uniform distribution of the magnetic field is created in the material processing area, i.e., the material is processed evenly in its full volume, according to the set exposure.

CONCLUSIONS

It was found that a relatively uniform magnetic field is created in the material processing area.

The values of the magnetic induction of the field when supplying the coil with a one-and-a-half-cycle voltage rectification circuit are much lower than when supplying with a bridge rectification circuit "Gretz".

When processing agricultural materials with magnetic field, using the obtained dependence curve B = f (U), variants with different magnetic induction of the field between the two pole tips of the magnetic system can be realized, which will allow to optimize the processing parameters. of various agricultural materials in a magnetic field.

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