631,371 UDC: 621.31

PRESOWING SEED CROPS IN A MAGNETIC FIELD

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The influence of magnetic field on seed crops. The dependences vigor and germination capacity of seed crops of magnetic induction and velocity of seeds in a magnetic field. The most effective treatment regimes.

Wheat, barley, germination energy, germination capacity, magnetic induction, the speed of the seeds.

Formulation of the problem. Now the urgent task is to improve crop yields and quality with minimal use of chemicals. This opportunity opens the application electrotechnologies.

Presowing seed crops in the magnetic field has a number of advantages over other electro-technological methods. Applied Transporter installation type permanent magnet having a lower cost and does not require special power supplies are simple to operate and can be used in production lines pre-treatment of seeds.

The use of energy and resource saving technologies necessitates the establishment of a mechanism of influence of magnetic field on seeds and determine the most effective mode of treatment.

Analysis of recent research. There are examples of successful use of pre-treatment of cereal seeds in a magnetic field with magnetic induction 0,04-0,06 Tesla. For this set of conveyor belt vygruznogo TZK-30 six pairs of magnetic modules at a distance of 110 mm from each other and from the conveyor belt at a speed of seed 1-1.3 m / s [6].

However, studies of the impact on grain magnetic field with magnetic induction of more than 0.01 T were not conducted because zapropovanyy processing mode is not optimal. In this regard there was a need for research on the influence of magnetic field on physical and chemical processes occurring in the seed and determine the optimal treatment regimes.

The purpose of research - The establishment of the magnetic field on the vigor and seed germination ability of crops.

Materials and methods of research. Experimental studies were conducted on the wheat variety "Natalie" and barley varieties "Solntsedar." Seeds moved on the conveyor through a magnetic field that give the permanent magnets.

Magnetic induction governing the change of distance between the magnets within 0-0,5 T and measured teslameters 43205/1. The velocity of the seed through a magnetic field regulated by frequency converter current. Processed in a magnetic field of wheat seeds germinated in accordance with GOST 10968-88 [2].

Energy grain germination percentage determined by the formula:

$$E = \frac{500 - n}{500} \cdot 100\ \%, \quad (1)$$

where: n - the number of grains sprouted for 72 hours, ea .; 500 - the number of grains in the analytical sample.

The ability of sprouting grain percentage was calculated using the formula:

$$ЗП = \frac{500 - n_1}{500} \cdot 100\ \%, \quad (2)$$

where: n1 - number of grains sprouted for 120 hours, pcs.

The influence of magnetic induction and velocity of germination energy and seed germination capacity of grain crops at magnetic treatment were conducted using experimental design theory [1]. The factors taken magnetic induction (X1) and the speed of the seeds (X2), and the output value - germination energy and seed germination ability of crops. On the basis of one-factor experiments were mentioned by the upper, lower and main levels of factors that accounted for magnetic induction respectively 0; 0,65 and 0,130 T, to the speed of the grain - 0.4; 0.6 and 0.8 m / s.

In studies used a composite orthogonal Central Plan [1]. Experiments performed in threefold repetition. Each row of the matrix defined planning dispersion and uniformity of criteria checked by Cochran.

The regression equation found in the form:

$$Y = b_0 + b_1 X_1 + b_2 X_2 + b_{11} X_1^2 + b_{22} X_2^2 + b_{12} X_1 X_2. \quad (3)$$

The coefficients in the regression equation and their significance was determined by a known method, and the adequacy of the resulting regression equation was estimated by Fisher criteria [1].

Results. Treatment of cereal seeds in a magnetic field affects the physical and chemical processes that occur in them. Under the influence of a magnetic field increases the rate of chemical and biochemical reactions that occur in cells [7], which helps stimulate seed growth and development of plants:

$$\omega_м = \omega \exp \mu(K^2 B^2 + 2KBv_n) N_a / 2RT, \quad (4)$$

where: ω - speed chemical reactions without the influence of a magnetic field mol / l · s; μ - reduced mass ions kg; B - magnetic induction, T; v - velocity of the ions, m / s; K - coefficient that depends on the concentration and type of ions, and the number peremahnichuvan m / s · T; Na - Avogadro's number, molecules / mol; R - universal gas constant, J / mol · K; T - temperature, K.

The magnetic field improves the solubility of salts and acids are found in plant cell, which is also a motivating factor in the life of plants [8]

$$\alpha_м = \alpha e^{\frac{\mu(K_i^2 B^2 + 2K_i Bv)}{2RT}}, \quad (5)$$

where: αm and α - degree of electrolytic dissociation and after treatment in a magnetic field.

When exposed to a magnetic field on cell membranes increases their permeability, which accelerates the diffusion through the membrane molecules and ions [3]. As a result, increases the rate of diffusion of oxygen molecules through the cell membrane and its solubility, thereby increasing crop yields and reduce morbidity due to the suppression of plant pathogenic fungi sporogonic process:

$$\Delta C = \frac{C_{1O_2} - C_{2O_2}}{2}\left(1 - e^{-\frac{2k_\partial (a + K_м gradB)^2 e^{-\frac{E_a}{kT}}}{\Delta L^2} t}\right), \quad (6)$$

where: C_{1O_2}, C_{2O_2} - In accordance with the concentration of oxygen molecules in cells 1 and 2 are separated by a membrane mol / l; kd - diffusion coefficient; Km - coefficient; Ea - activation energy, J; -stala k Boltzmann J / K; ΔL - membrane thickness, m.

In addition, increased permeability of cell membranes and the rate of chemical reactions seed treatment in a magnetic field causes an increase in water absorption seed, which accelerates the development of plants and improves yield [4]

$$\Delta m = \rho \Delta V = \frac{C_1 e^{-\frac{\mu(K^2 B^2 - 2KBv_{n*})}{2RT}} - C_2}{C_1 e^{-\frac{\mu(K^2 B^2 - 2KBv_{n*})}{2RT}} + C_2} \rho V \left(1 - e^{-\frac{k_\partial (a + K_м gradB)^2 e^{-\frac{E_a}{kT}}}{\Delta L^2} t}\right), \quad (7)$$

where: ρ - the density of water, kg / m3.

Under the influence of the Lorentz force increases ion transport, thus increasing the concentration of mineral elements that came into the cell [5]

$$\Delta C_{i_2} = C_{i_1} v_i^0 f_i N_n E \tau (a + \frac{2K_м B}{\tau})(\frac{a}{v} + \frac{2K_м B}{\tau v} + \frac{1}{2} K_к K_в B)\, e^{-\frac{\mu(K_i^2 B^2 + 2K_i B v)}{2RT}}, \quad (8)$$

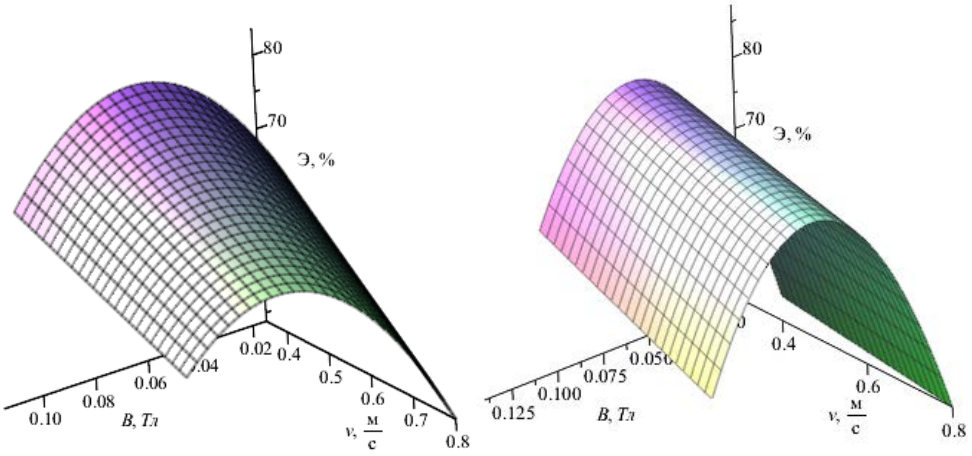
where: v_i^0 - Absolute velocity of the ion, m / s; fi - conductivity coefficient; E - electric field in the cell, V / m; and - the size of the pores in the cell, m .; τ - pole division, m.

Based on theoretical studies found that seed treatment should be carried out in an inhomogeneous magnetic field, and the use of periodic magnetic field increases the effect of treatment. Changing the physical and chemical characteristics of seeds at magnetic treatment depends on the square of the magnetic induction and velocity of their motion in the magnetic field. As a result of the magnetic field increases vigor and ability to seed germination and crop yields.

The results of the multivariate experiment obtained regression equation in physical terms has the form (Fig. 1) for wheat (9) and barley (10):

$$E = 80.021 + 680.889B - 60.889v + 300Bv - 5733B^2. \quad (9)$$

$$E = 52.907 + 1021B - 8.611v - 153.846Bv - 6062B^2. \quad (10)$$



a b

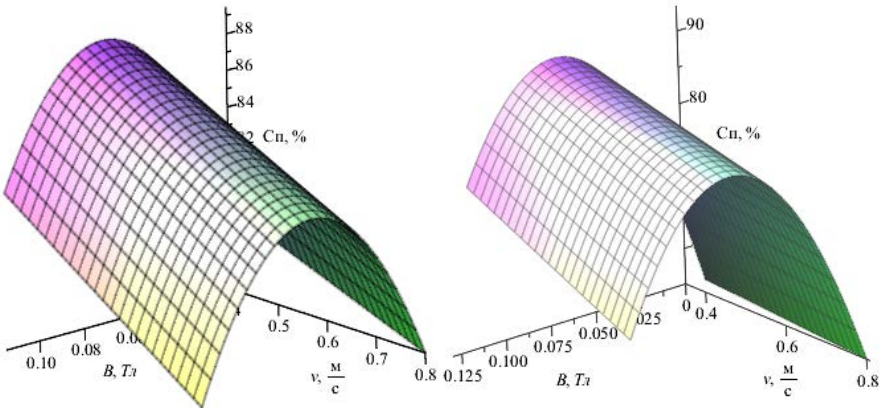
Fig. 1. Change vigor grain seed treatment in a magnetic field: a - wheat; b - grain barley.

Changing magnetic induction from 0 to 0,065 T vigor increases and with further increase of magnetic induction begins to decrease. Established that the magnetic induction exceeding 0,130 T, energy and germination varies slightly for wheat is 64% (in control - 34%) for barley - 70% (in control - 48%).

The regression equation that relates the ability of sprouting grain with the parameters of the magnetic field, the physical quantities has the form (Fig. 2): for wheat (11) and barley (12)

$$ЗП = 75.831 + 533.667B - 9.875v - 91.667Bv - 3511B^2; \quad (11)$$

$$ЗП = 58.63 + 988.034B - 4.444v - 192.308Bv - 5667B^2. \quad (12)$$



a b

Fig. 2. Change the germination capacity of grain seed treatment in a magnetic field: a - wheat; b - grain barley.

Changing magnetic induction from 0 to 0,065 T germination capacity of grain growing, and with further increase of magnetic induction begins to decrease. When magnetic induction exceeding 0,130 T, germination capacity and is slightly changed for wheat 78% (in control - 70%), barley - 78% (In control - 56%). It was established that the energy of germination of cereal seeds and its germination capacity with a maximum value at 0,065 T magnetic induction. In all experiments, the effect of magnetic treatment depended on the speed of the seeds. However, the speed range 0.4-0.8 m / s, it is a less significant factor than the magnetic induction. The best results were obtained at a speed of 0.4 m / s.

Conclusion. Vigor and germination capacity of grain crops at magnetic treatment depends on the square of the magnetic induction and velocity of seeds in a magnetic field. The most effective mode of treatment occurs when magnetic induction of 0,065 T and the speed of the seeds of 0.4 m / s.

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Pryvedenы results of research Effect of magnetic field on seeds of grain crops. Ustanovlenы prorastanyya energy dependence and abilities prorastanyya semyan grain crops such mahnytnoy induction and velocity of motion semyan a magnetic field. Opredelenы most эffektyvnыe regimes processing.

Wheat, barley, Energy prorastanyya, prorastanyya Ability, Magnetic induction, movement velocity semyan.

The results of research on the influence of magnetic field on seed crops are shows. The dependencies of germination energy and germination property of cereals by magnetic induction and speed of seeds in a magnetic field are established. The most effective treatment regimens.

Wheat, barley, germination energy, germination property, magnetic induction, speed of seed.