

Chapter 9

Energy–Saving Technologies for Pre–Sowing Seed Treatment in a Magnetic Field

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ABSTRACT

The purpose of the research was to establish the mechanism of the magnetic field impact on seeds to determine the most effective mode of pre-sowing treatment of seeds in a magnetic field and design parameters of the device for magnetic treatment of seeds. It is established that under the influence of a magnetic field the rate of chemical reactions occurring in plant cells is accelerated, solubility of salts and acids increases, and permeability of cell membranes accelerates the diffusion of molecules and ions through them. This leads to an increase in the concentration of ions in the cell and oxygen molecules and the growth of water absorption of seeds. Pre-sowing seed treatment promotes increased germination by 25-40%, and germination by 30 - 35%. The most effective pre-sowing treatment of seeds in a magnetic field is a magnetic induction of 0.065 Tl with four reversal magnetization, a pole division of 0.23 m and a seed movement speed of 0.4 m/s. With this mode of treatment, crop yields increase by 20–25%.

INTRODUCTION

The use of electrotechnological methods of pre-sowing seed treatment makes it possible, without the use of chemical agents, to increase the yield of agricultural crops, reduce the incidence of plants, and improve the quality of products and storage periods.

Pre-sowing seed treatment in a magnetic field compared with other electrophysical methods is characterized by high plant productivity, low energy consumption, and is safe for the environment and maintenance personnel.

Many researchers have established the positive influence of the magnetic field on seeds of crops, which manifests itself in improving the sowing quality of seeds, the growth of biometric indices and the decrease in plant morbidity, increase in crop yields and product quality.

Since the seed material has certain biological properties, it is therefore necessary to use such regimes that correspond to the specific biological properties of the seed material and give maximum effect to its treatment.

Nowadays, the mechanisms and regularities of the the magnetic field impact on aqueous solutions and biological objects are not fully disclosed. The absence of an explanation of the magnetic field effect on the processes occurring in the seeds makes it impossible to establish all the active factors when it is processed in a magnetic field and to determine their optimal values.

The purpose of research is to establish the mechanism of the magnetic field impact on seeds, to determine the most effective mode of presowing seed treatment in a magnetic field and the design parameters of a device for magnetic seed treatment.

BACKGROUND

Synthesis of organic matter in plants comes from water, mineral salts and carbon dioxide. All biochemical processes in plant cells occur in an aqueous medium. The transport of the elements of the power into the cell is provided by two autonomous mechanisms - the passive flow of matter with the electrochemical gradient and their active transport against the electrochemical gradient (Yagodin, Zhukov, & Kobzareno, 2002).

The ions pass through the membrane as a result of the diffusion process or together with the solvent. The membrane also provides direct passage of water and dissolved substances in it. The constant passage of ions through the membrane results in a continuous flow of new ions into it to equalize the concentration.

Since the ions have an electric charge, the process of their passage through the membrane depends on the difference in concentration and the magnitude of the diffusion potential arising between the two solutions with different concentrations of matter separated by the membrane.

The electromagnetic field affects the transport of ions and molecules of substances in the cell, contributes to increasing the sowing quality of seeds and yields of crops. In recent years, electrophysical methods have been developed for the seed treatment of certain crops in the electric field of corona discharge, magnetic field, electromagnetic radiation, etc. Based on the analysis of the electrophysical methods of seed treatment, one can conclude that magnetic seed treatment is a promising method that has significant advantages over other methods. (Zholobova, 2012).

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