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Mitotic activity stimulation of corn apical root meristems under the influence of a low-frequency magnetic field

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Mitotic activity (MA) of meristems is the important parameter defining plants proliferation intensity. These processes substantially determine their morphological characters of plants and their physiological characteristics showing in rates of development and productivity. MA stimulation can lead to the subsequent activation of morphogenetic processes. As a result all the factors raising MA, are of interest for plant growing. Many biotechnological processes are connected with cell multiplication therefore an opportunity of MA management represents independent value for the decision of various applied problems. Among them are biomass development of producers of pharmacological, alimentary, cosmetic and other matters, regeneration of the whole plants from the separate cells subjected to various bioengineering operations, a vegetative propagation and rootage of unique specimens, sporophyte production from gametes, selection at a cellular level, generation of polyploids, mutants.

We already marked a stimulating effect of a low-frequency magnetic field (MF) with the certain parameters on apical root meristems MA of various floral plants sprouts (in Russian: Belyachenko et al. Biomedical technologies and radioelectronics 11:57-60, 2007; Belyachenko et al. The bulletin Saratov University. Chemistry. Biology. Ecology. 8(2):84-88, 2008; Belyachenko et al. The bulletin Saratov State Agrarian University 6:5-8, 2009). Such MF parameters which led to the greatest change of physical properties of water (in Russian: Usanov et al. Biomedical technologies and radioelectronics 5-6:65-69, 2006) have been chosen. The purpose of the present work was research of influence of alternating MF on apical root meristems MA of corn line Precocious Purple Tester.

Dry or preliminary wetted in water (within 18 hours) corn seeds were exposed to MF influence. Root tips 1-1,5 cm long were fixed for cytological analysis. Amounts of cells at different stages of a cellular cycle were estimated on temporary acetocarminic squash preparations. In each of

three repeatabilities it has been analysed not less than 3000 cells and mitotic index values were calculated.

It is established, that MF with frequencies from an interval 1-12 Hz renders a promoting effect on corn MA. Distinctions on effect magnitude for different frequencies of MT are noted. The greatest level of stimulation (29%) corresponds to influence of alternating MF at frequency of 9 Hz.

In practice it's ordinarily to face with significant corn seed dimension and quality variations. Therefore the special series of experiments for revealing the probable dependence of seeds size on stimulating effect value have been lead. Besides various variants of MF influence (on dry and wetted seeds) have been realized.

It is shown, that for the sprouts received from seeds of the different size, distinctions in levels of MA stimulation can be observed. The size of stimulating effect can be different for the same objects depending on its state (MF action dry or wetted seeds).

The stimulating effect on corn meristems is observed at 1 and 3 Hz MF influence on corn seeds during 6 h. In this case the average level of MA stimulation is about 8-10 %. The greatest (or significant) effect is typical for the sprouts received from big corn seeds.

Getting the stimulating effect by dry seeds exposition in MF is perspective in connection with suitability of this variant for large-capacity processing with the research and economic purposes. MA stimulation of sprouts from small seeds represents the special interest as the small seed size is usually connected with its low quality that is one of the causes of possible delay of the plants in growth and development. MA increase of those plants sprouts can render beneficial effect on their further development.

Obtained data are the establishment for MF application in agricultural practice and various biotechnological processes demanding increase of dividing cells amount. Use of MT for various economic significant effects achievement in comparison with other physical and chemical factors application has a number of advantages. Technological process of MF influence on plants is simple, highly profitable and ecologically clean. Dry or wetted seeds which if necessary can contain in sterile conditions can be exposed to MF influence.