

ник у рослин дослідних варіантів незначно знижувався порівняно з контрольними значеннями. Встановлено, що в умовах 2016 року досліджувані біостимулятори не сприяли зростанню ЧПФ на початкових етапах вегетації гороху. Позакореневі обробки біопрепаратами покращували параметри та функціонування фотосинтетичного апарату рослин гороху, тому за дії Стимпо та Регопланту у фазі цвітіння та бобоутворення ЧПФ перевищувала контрольні показники від 6,3% до 20,0%. Використання Стимпо та Регопланту викликало збільшення кількості бобів на рослині на 22% та 34%, а маси 1000 насінин на 5% та 6% відповідно. Як результат, за дії Стимпо біологічна врожайність гороху зросла на 24%, а за дії Регопланту - на 30% порівняно з врожайністю контрольних посівів (2,9 т/га).

Використання біостимуляторів Стимпо та Регоплант в умовах Південного Степу України покращували параметри та функціонування фотосинтетичного апарату рослин гороху, що вірогідно збільшило біологічну врожайність посівів.

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STUDY OF SPATIAL ORGANIZATION OF PLANT ACTIN FILAMENTS AFTER COLD TREATMENT BY MICROFILAMENT ANALYZER PROGRAM

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The actin cytoskeleton is a network of filamentous proteins that functions in diverse cellular processes in plants. In plant cells, several cellular processes depend on, or are coincident with, reorganization of the actin cytoskeleton, including cell division and differentiation, cell shape determination, organelles movement, cell wall deposition, light-induced plastid migration, wound repair and response to pathogen attack. Low temperature is one of the most important abiotic factors limiting growth and development in plants. In a number of studies it has been shown that low temperature leads to significant changes in the organization of microtubules and microfilaments, including their depolymerization. The MicroFilament analyzer (MFA) program detects the filamentous structures on the image and identifies the main orientation(s) within individual cells, and it has been used for several studies on analysis of microtubule organization. Our research demonstrates the use of MFA program to study the organization of actin filaments in different cells of *A. thaliana* roots under cold action.

Four-days-old seedlings of *A. thaliana* (L.) Heynh. line expressing the chimeric gene 35::GFP-ABD2-GFP were used in the experiments. For visualization of actin filaments in different types of root cells of *A. thaliana* (GFP-ABD2-GFP) seedlings the confocal laser scanning microscope LSM 510 META was used. To analyze the microfilaments' orientation after exposure to temperatures +4° and +0.5°C MFA software has been applied.

The effect of low temperatures on the organization of actin filaments (microfilaments) of cells from different growth zones has been studied in the roots of *A. thaliana*. It was found that cold treatment inhibits the growth of the primary root and changes its morphology, causing a formation of large number of deformed (ectopic) root hairs in differentiation zone (+4°C) and causes an anisotropic increase in the diameter of epidermal cells in elongation zone (+0.5°C). The temporal relationship between the disorientation and the organization of actin filaments and the detected changes of root growth and morphology after cold treatment was estimated. It has been found that actin fila-

ments of root hairs, meristematic cells, cells of elongation zone, and epidermal cells of all root zones of *A. thaliana* are the most sensitive to the cold. Previously, it was shown that microfilaments remained intact in the cytoplasm of the pollen tubes of tobacco (*N. tabacum*) after exposure to +4°C, while microtubules were destroyed under these conditions. After exposure of BY-2 cell culture (*N. tabacum*), there was a violation of the organization of actin filaments at 0°C followed by the formation of a disordered network of microfilaments and their partial depolymerization. The organization of actin network was disrupted and microfilaments depolarized in the cells of winter rape culture under the influence of low temperature. The analysis by MFA showed that cold stress and exposure time are important factors affecting the orientation of actin filaments. We found that not only the dynamic dilution of actin network and polymerization/depolymerization of actin in cells of different zones of the root apex occurs, but microfilament orientation changes also after cold treatment.

Using MFA software to determine the effects of low temperatures on microfilaments is essential for a more accurate and detailed understanding of cold effect on the behavior of these filamentous structures in *A. thaliana* in a quickly and standardized manner.

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ADAPTOGENIC IMPACT OF EPIN EXTRA ON *CUCUMIS SATIVUS* L. SEEDLINGS GROWTH UNDER CADMIUM STRESS

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Technological development of mankind has brought not only an improvement the life quality, but also significant problems, the most harmful of which is environmental pollution, including heavy metals. One of the most toxic metals for all living organisms is cadmium. The possible way to reduce the content of heavy metals in agricultural products could be a plant treatment with growth regulators. Currently, brassinosteroids are considered as effective endogenous growth regulators with growth-stimulating and stress-protective activity.

The aim of our research was to study the effect of Epin Extra preparation on seed germination and the catalase activity for the *Cucumis sativus* L. variety Phoenix Plus under the influence of cadmium acetate. To achieve this goal, prior it was necessary to determine the optimal concentration of Epin Extra, exposure time for the presoaking seeds treatment, and the activity of the catalase in germinating seeds under the action of various concentrations of cadmium acetate.

The research was carried out with seeds of *C. sativus*, presoaked in a 0.05% solution of the Epin Extra and germinated in cuvettes on a filter paper with addition different concentration of cadmium acetate (10^{-2} – 10^{-4} M, 100 μ M and 250 μ M), control – tap water. Seed were presoaked with Epin Extra during 4 hours. The energy of germination and germination percentage of cucumber seeds were determined according to GOST 12038-84, catalase activity determined by the gas-metric method.

As a result of the laboratory experiments, a positive anti-stress effect of the Epin Extra on the germination of *C. sativus* seeds and catalase activity under cadmium acetate impact.

Germination of seeds in solutions with various concentrations of cadmium acetate was inhibited from the first days of experiment. At the concentration 10^{-2} M, seed germi-