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CONTENT

AGRICULTURAL SCIENCES

Dubrovskaya N. EFFICACY OF THE FUNGICIDES VIAL TT, DIVIDEND STAR AND RAXIL AGAINST THE CAUSATIVE AGENT OF WHEAT SMUT.....3	Rezvichkiy T., Tikidzhan R., Pozdniakova A., Mitlash A., Kalashnik V. BLISTER SMUT ON CORN CROPS19
Matsera O. YIELD AND QUALITATIVE PROPERTIES OF WINTER RAPESEED HYBRIDS DEPENDING ON THE APPLIED NORMS OF FERTILIZERS AND TERMS OF SOWING.....4	Rezvichkiy T., Tikidzhan R., Pozdniakova A., Mitlash A., Kalashnik V. COMPARATIVE CHARACTERISTICS OF PRODUCTIVITY CHARACTERISTICS OF WINTER WHEAT VARIETIES IN RICE CROP ROTATION CONDITIONS.....21
Pushkarev V., Martynova E. CUCUMBER YIELD IN PROTECTED GROUND CONDITIONS IN THE NORTH-WEST OF RUSSIA15	Rezvichkiy T., Tikidzhan R., Pozdniakova A., Mitlash A., Kalashnik V. PROTECTION OF WINTER RAPE SEEDS FROM THE TENACIOUS BEDSTRAW.....24
Pushkarev V., Kotov V. YIELD OF WHITE CABBAGE WHEN USING HERBICIDES17	Rezvichkiy T., Tikidzhan R., Pozdniakova A., Mitlash A., Kalashnik V. PROTECTION OF BARLEY CROPS FROM POWDERY MILDEW AND BROWN RUST27

BIOLOGICAL SCIENCES

Pozdnyakova A., Rezvichkiy T., Tikidzhan R., Mitlash A., Kalashnik V. CONTROL SYSTEM AGAINST SUNFLOWER BROOMRAPE ON THE TERRITORY OF THE KRASNODAR TERRITORY30	Pozdnyakova A., Rezvichkiy T., Tikidzhan R., Mitlash A., Kalashnik V. THE INFLUENCE OF INDOOR PLANTS ON THE PSYCHO- EMOTIONAL STATE OF A PERSON34
Pozdnyakova A., Rezvichkiy T., Tikidzhan R., Mitlash A., THE SYSTEM OF CONTROL AGAINST FALSE-POWDERY SUNFLOWER IN THE TERRITORY OF THE KRASNODAR TERRITORY.....32	Khodanitska O., Shevchuk O., Tkachuk O., Matviichuk O. PHYSIOLOGICAL ACTIVITY OF PLANT GROWTH STIMULATORS36

CHEMISTRY SCIENCES

Kudriavtseva E., Burinskaya A. ECO-FRIENDLY WAY OF SYNTHESIS OF BIMETALLIC COPPER AND SILVER NANOPARTICLES.....39	Kulikov M. ELECTRONIC ABSORPTION SPECTRA OF BROMOBENZALACETONE AND ITS DERIVATIVES45
--	---

PHYSICS AND MATHEMATICS

Yurov V., Kusenova A. NATURAL SCIENTIFIC MODELS IN PEDAGOGICAL PROCESS.....49
--

TECHNICAL SCIENCES

Krol K. ANTI-RISK MANAGEMENT TOOLS OF STAKEHOLDERS IN AGRO-INDUSTRIAL COMPLEX.....58	Sobol A., Andreeva A. APPLICATIONS AND OPPORTUNITIES USING AUTONOMOUS ASYNCHRONOUS GENERATORS IN POWER PLANTS BASED ON ORENEWABLE ENERGY SOURCES.....65
Vystavkina E. ANALYSIS OF APPLICATION OF ENVIRONMENTAL ENGINEERING CONSTRUCTION.....63	Chub O. FUNCTIONAL DESSERT DISHES: ENSURING THE SAFETY AND QUALITY BY USE OF UNTRADITIONAL AND SECONDARY PLANT RAW MATERIALS68

PHYSIOLOGICAL ACTIVITY OF PLANT GROWTH STIMULATORS**Khodanitska O.,***PhD of Agricultural Sciences, Associate Professor,
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Vinnytsia Mykhailo Kotsiubynskyi State Pedagogical University*DOI: [10.24412/9215-0365-2021-58-1-36-38](https://doi.org/10.24412/9215-0365-2021-58-1-36-38)**Abstract**

The article considers the physiological activity of plant growth stimulants based on phytohormones. Plant growth regulators by their nature are analogs of phytohormones or modifiers of their action. Therefore, the physiological effect of growth stimulants is determined by changes in the balance of biologically active substances in the plant organism. The use of developmental stimulants containing compounds of auxin, gibberellin, cytokinin and brassinone nature is substantiated. Exogenous treatment of compounds with analogues of phytohormones, their antagonists or regulators of activity, intensively effect on the metabolic processes and lead to changes in growth processes, allows improving of the seed productivity of plants.

Keywords: phytohormones, plant growth stimulants, auxins, cytokinins, gibberellins, brassinosteroids, productivity, germination.

Regulation of plants growth and development is one of the important problems of modern crop production and plant physiology [1]. Today we know about 5,000 biologically active substances, some of which have found practical application in agricultural production. Growth regulators are increasingly used in modern technologies for crop production. They can be natural and synthetic organic compounds that affect metabolic processes in plants and stimulate or inhibit their growth and morphogenesis [2, 6].

Phytohormonal regulation of plant morphogenesis is a perspective direction in the development of agricultural technologies. Physiological activity in a plant organism is determined not by the content of particular groups of phytohormones, but mainly determined by the balance of biologically active substances [16].

Exogenous treatment of compounds with analogues of phytohormones, their antagonists or regulators of activity, intensively effect on the metabolic processes and lead to changes in growth processes, allows improving of the seed productivity of plants [3].

Growth regulators are substances of synthetic and natural origin that have biological activity and in microdoses can cause changes in morphophysiological processes and affect crop productivity. Growth regulators make it possible to regulate the growth and development of plants; more effectively realize the potential of varieties and hybrids that inherent in the genome by nature, selection or genetic engineering [7].

Plant growth regulators, depending on the direction of their influence on the plant organism, are divided into stimulants and inhibitors of plant growth and development [4]. The biologically active substances contained in such preparations cause a wide

range of protective reactions, increase of metabolic processes, resistance of plants to environmental stressors and improvement of product quality.

The action of plant growth stimulants of synthetic origin is associated with the acceleration of the processes of cell division, stretching and differentiation, increase of the linear size of plants, increase of the assimilation surface area and productivity of plants [5, 15].

Synthetic plant growth regulators are analogs of natural growth substances – phytohormones [8]. They accelerate the growth, development and productivity of plants due to increased activity or their content in tissues [11]. Modern growth stimulants are combined drugs that influence on the complex of phytohormones. Phytohormones, having a multifunctional action, regulate many biochemical processes in plants [9, 12]. Receptor proteins contained in the middle of the cell bind to hormones. The hormone-receptor complex is responsible for the regulation of physiological and biochemical processes in the plant.

There are two types of receptors: intracellular soluble receptor proteins that bind phytohormones and migrate between the cytoplasm and the nucleus; membrane receptor proteins that bind phytohormones from the extracellular space.

Intracellular receptor proteins, when they bind the phytohormone, cause gene expression and affect metabolism in the cell. Bind proteins of the first type are found for gibberellins, auxins and cytokinins. Membrane receptor proteins realize the physiological and biochemical role of phytohormone, increase the concentration of mediator metabolites in the cell. Accordingly, phytohormones activate special genes responsible for the synthesis of essential enzymes. Phytohormones determine the structure and function of ribosomes, cell

membranes, endoplasmic reticulum, changes cell metabolism. The genome of plants controls the biosynthesis of phytohormones themselves.

Plant growth stimulants of phytohormonal origin are classified into [1]:

1. Gibberellin drugs and analogues created on their basis (activol, gibrelat, gibreskol).
2. Auxin preparations and their synthetic analogues (heteroauxin, 2,4-dichlorophenoxyacetic acid (2,4-D), 1-naphthylacetic acid, its potassium salt).
3. Cytokinin drugs and their synthetic analogues (kinetin, cytoDEF, 6-benzylaminopurine, diphenylurea), benzimidazole and benzimidazolone derivatives.
4. Brassinosteroids as stimulants of the immune system of plants (epibrasinolide, homobrasinolide, zircon).
5. Ethylene inhibitors (aviglycin and its hydrochloride, aminoxyacetic acid).

Synthetic analogues of phytohormones, in contrast to natural biologically active substances, are more stable in the plant organism and are characterized by a prolonged action over time. However, there are no regulators of plant growth of the universal type that would affect the development of plants at all stages of ontogenesis [10, 14].

It is noted that application of growth-regulating compounds increase in simultaneity and seed germination energy, accelerate the shoot and root system growth, which leads to improve the absorption of nutrients from the soil, the resistance of plant organism to the action of extreme environmental factors.

Phytohormones and their synthetic derivatives compounds stimulate to increase in the proliferation and accelerate the processes of cell differentiation, which caused formation of a more powerful root system and changes of leaf mesostructural organization. The enhanced development of assimilative apparatus leads to the intensification of organic substances synthesis, which are used for the needs of formation and generative organs loading, that is an important key to improving crop yields.

Growth stimulants are used to increase field germination of seeds, stimulate root formation and photosynthesis, accelerate ripening, increase yields, improve product quality, reduce disease and contain of heavy metals in products. Thus, an artificial analogue of auxins – β -indolylbutyric acid (0.25-0.5% aqueous-alcoholic solution) is used for rapid rooting of cuttings and the formation of the root system of plants [1].

Auxins play an important role in the vegetative reproduction of plants that are difficult to root, or to restore the root system when transplanting large plants due to their ability to accelerate root growth. In addition, they are used to obtain parthenocarpic fruits, thinning of flowers and ovaries in fruit trees, which are associated with the formation of ethylene, which in turn accelerates fruit ripening. Auxins are often used to kill dicotyledonous weeds (chlorophenoxy acids).

Cytokinins and their analogues play an important role in the regulation of plant growth and development. 6-benzylaminopurine (6-BAP) is used to increase plant resistance to disease and other stressors, as well as in the cultivation of tissues and organs [11].

The practical use of synthetic analogues of cytokinins is based on physiological properties and is associated with obtaining bushy forms of plants (removal of apical dominance), inhibition of leaf aging, induction of flowering and shifting the expression of plant sex with the formation of more female flowers.

Cytokinins with auxins are one of the components of nutrient environment in biotechnology and are necessary to accelerate organogenesis during the cultivation of plants in tissue culture. With the help of cytokinins and their analogues, it is possible to influence the formation of organs and flowering of plants under conditions of unfavorable photoperiodic regime. Cytokinin drugs are used to increase the resistance of plants to deficit of moisture, high and low temperatures, fungal pathogens.

Gibberellins are important for plant development, especially for stem growth. Low levels of gibberellins do not allow plants to reach natural heights. Therefore, inhibitors of gibberellin synthesis are widely used in agriculture to form stems artificially short: shorter and thicker stems provide better support, as well as better resistance to weather conditions.

Gibberellins are especially effective when the seeds come out of dormancy, to accelerate germination, increase germination energy. Seeds that germinate difficult are often soaked in solutions of gibberellic acid, after which the general germination improves.

It is known from the literature that gibberellins affect cell division. Gibberellins increase the linear size of the plant, stimulate cell stretching and division. A classic example of the use of gibberellin is the cultivation of grapes without seeds. Treatment of plants with gibberellins can increase resistance to phytopathogens.

High physiological activity is characteristic of brassinosteroids, such as epine. Epine is a plant growth regulator, the active ingredient of which is a natural, environmentally friendly brassinosteroid, which even in microdoses has a high biological activity. It changes the phytohormonal balance in plants, can increase crop yields in stressful situations, resistance to disease, reduces the negative impact of plant uptake of radionuclides and heavy metals.

Thus, plant growth and development stimulators are heterogeneous group of compounds used in agriculture to optimize productivity, improve harvesting conditions, store products and ensure its high quality characteristics.

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